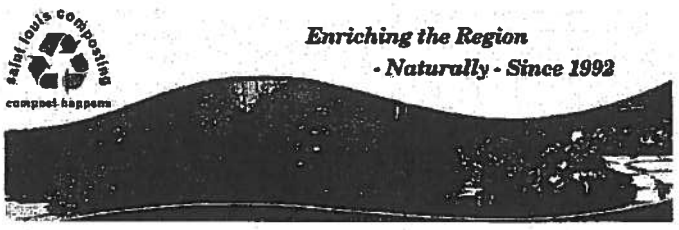
APPENDIX C

STORM WATER POLLUTION PREVENTION PLAN

STORM WATER POLLUTION PREVENTION PLAN
St. Louis Composting, Inc.
Valley Park, Missouri

Aquaterra Project No. 3664.10
November 2009

Prepared For:



St. Louis Composting, Inc.
39 Old Elam Road
Valley Park, Missouri 63088

AQUATERRA

STORM WATER POLLUTION PREVENTION PLAN CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

_____

Signature

Dixie Franklin

Name

Compliance Manager

Title

_____

Date

AMENDMENT SCHEDULE

This Storm Water Pollution Prevention Plan (SWPPP) requires periodic updates to address changes in site conditions, facility operations, and/or government regulations. The original plan should be included at the top of the amendment schedule provided below. Meetings where the SWPPP is discussed shall be documented using the form provided in Appendix G.

Amendments to the SWPPP must also be documented on the SWPPP amendment schedule. The authorized representative who approves the revised SWPPP should be an individual at or near the top of the facility's management organization, such as the district manager, facility manager or environmental manager. The signature of this representative in the appropriate space below attests that the SWPPP amendment information is true and accurate. Amendments to the SWPPP can be inserted into the correct part of the original SWPPP, and properly identified as a revision, or the entire document may be revised for clarity.

Amendment Schedule

Amendment	Date	Approved By
	November 2009	

CONTRACTOR & SUB-CONTRACTOR SWPPP NOTIFICATION

A copy of the SWPPP should be provided to all contractors and sub-contractors involved with construction activities on site. All applicable contractors must be notified if changes to the SWPPP are made during their involvement with construction activities on site. Contractors and sub-contractors should sign, date, and write a brief description of intended work including an estimated completion date on the table below to certify that they comprehend the Best Management Practices (BMPs) detailed in the SWPPP prior to commencing with activities on site.

Contractor / Sub-contractor List

Description of Work	Completion Date	Contractor / Sub-contractor Signature	Date

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STORM WATER POLLUTION PREVENTION PLAN
ST. LOUIS COMPOSTING, INC.
November 2009

1.0 INTRODUCTION

This Storm Water Pollution Prevention Plan (SWPPP) covers the operations at the St. Louis Composting, Inc. facility located in Valley Park, Missouri. This SWPPP describes this facility and its operations, identifies potential sources of storm water pollution at the facility, recommends appropriate Best Management Practices (BMPs) or pollution control measures to reduce the discharge of pollutants in storm water runoff, and provides for periodic review of this SWPPP. The purpose of the SWPPP is to ensure that runoff from the St. Louis Composting, Inc. facility adheres to the following water quality standards:

- Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits, or prevent full maintenance of beneficial uses;
- Waters shall be free from oil, scum, and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;
- Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor, or prevent full maintenance of beneficial uses;
- Waters shall be free of substances or conditions in sufficient amounts to result in toxicity to human, animal, or aquatic life;
- There shall be no significant human health hazard from incidental contact with water;
- There shall be no acute toxicity to livestock or wildlife watering;
- Waters shall be free from physical, chemical, or hydrologic changes that would impair the natural biological community;
- Waters shall be free from used tires, car bodies, appliances, demolition, debris, used vehicles, or equipment and solid waste as defined in Missouri's Solid Waste Law.

The control measures outlined are intended to meet the requirements of the Environmental Protection Agency (EPA) and the Missouri Department of Natural Resources (MDNR). An implementation schedule is prescribed so as to ensure that the storm water management actions prescribed in this SWPPP are carried out and evaluated on a regular basis. This report follows BMPs according to the site's general permit

Revision of the SWPPP will occur if needed following evaluation of storm water management actions and any storm water analyses in order to meet EPA and MDNR requirements. Further, the SWPPP will be amended when changes in design, construction, operation or maintenance of the landfill and support facilities affect the potential for discharge of pollutants in storm water.

A complete copy of this plan shall be maintained onsite at the facility's office, and shall be made readily available to agents of the MDNR, EPA or local storm water management agencies upon request during normal working hours.

2.0 PLANNING AND ORGANIZATION

2.1 Pollution Prevention Team

The storm water pollution prevention team is responsible for developing, implementing, maintaining and revising this SWPPP. The team is tasked with defining and agreeing upon an appropriate set of goals for the facility's storm water management program. The team must be aware of any changes in facility operations to determine whether any changes must be made to the SWPPP. The members of the team should be familiar with the management and operations of the St. Louis Composting, Inc. facility.

The team leader will maintain inspection schedules and records, oversee employee training, and coordinate responses to spill emergencies. The team leader will be the main facility contact person for communications with MDNR, EPA and local storm water management agencies. Evaluation and modification of the SWPPP should occur annually and whenever a significant spill event occurs. Changes at the facility which may warrant a modification of the SWPPP include:

- Relocation or alteration of material storage or handling areas,
- Revision of BMPs,
- Alteration of drainage patterns,
- Revision of composting limits,
- Alteration of storm water sampling points or analysis parameters, or
- Addition of erosion and sediment control measures.

Appendix A contains a list of the team members for the facility and each person's responsibilities. A copy of the material found in Appendix A should be posted within the facility so that all employees are aware of who is responsible for storm water management.

2.2 Existing Environmental Plans

The facility's current Spill, Prevention Control and Countermeasures (SPCC) Plan (dated November 2009) contains a number of elements relevant to the control of storm water contamination and runoff.

- Dixie Franklin, Compliance Manager, serves as the signatory on both documents and is the SPCC Coordinator.

- A complete description of the potential for petroleum products to contaminate storm water discharges, including quantities, is found in the SPCC Plan.
- Spill prevention and response training may be combined for SPCC plan training and SWPPP requirements.
- Relevant portions of the SPCC plan will be included in this plan.

3.0 SITE ASSESSMENT

3.1 General

Name of Facility:	St. Louis Composting, Inc.
Mailing Address:	39 Old Elam Road Valley Park, Missouri 63088
Site Address:	39 Old Elam Road Valley Park, Missouri 63088
Telephone:	(636) 861-5927
Compliance Manager:	Dixie Franklin
Operating Hours:	M-F 6:00 AM – 5:00 PM; Sat 7:00 AM – 3:00 PM; Sundays as needed.
Number of Employees:	22
Permit Information:	
Facility Permit Name:	St. Louis Composting, Inc.
Permit Number:	MOG970035
Legal Description:	Land Grant #1983, St. Louis County
Receiving Stream:	A private lake discharging to the Meramec River

3.2 Description of Site Area

St. Louis Composting, Inc. owns and operates a 26-acre composting and wood chipping facility located northwest of the intersection of Interstate 44 and Highway 141 on Old Elam Road in Valley Park, Missouri. St. Louis Composting, Inc. was issued General Permit MOG970035 on October 22, 2009 by the Missouri Department of Natural Resources for storm water discharges from yard waste composting activities incorporating less than 20 acres of the site. The facility consists of an approximate 10.3-acre composting area, an approximate 5.1-acre wood chipping area, approximately 7.1-acres of vegetative area, and

approximately 3.5-acres of land used for office space, parking lots, equipment storage, and roadways. The general site location is shown on the Site Location drawing in Appendix B.

A representative of Aquaterra Environmental Solutions, Inc. completed a site inspection visit in October 2009. Observations made during the assessment were supplemented by discussions with the Compliance Manager, Dixie Franklin.

3.3 Site Drainage

Storm water from the composting facility discharges from a single outfall into a private lake. Storm water is contained within the private lake, unless the nearby Meramec River is at flood stage. In the event of a flood, Storm water from the site could discharge into the Meramec River. Outfall #001 is located at the western boundary of the property. Approximately 26 acres drains to Outfall #1. A detailed drawing of the facility may be found in Appendix B. This drawing details the outfall, roads, composting areas, wood chipping areas, material storage areas, and equipment storage areas for the facility.

The average annual precipitation for the Valley Park area is approximately 37.51 inches. Rainfall is fairly evenly distributed throughout the year. The wettest month of the year is May with an average rainfall of 3.97 inches.

3.4 Material Inventory

The site was inspected for significant materials such as fuels, solvents, detergents, lubricants, etc., which have potential for being released with storm water discharges. Emphasis was placed on materials that may have been exposed to storm water in the past three years. Review of the facility's current SPCC Plan supplemented the inspection.

Located at the east side of the property, east of the composting area and north of the office building, Storage Locker #4 contains a 350-gallon tank containing A-W46 hydraulic oil, a 222-gallon tank holding engine oil, and a 60-gallon tank containing grease for lubricating machines. The storage locker is also used to hold small amounts (less than 55-gallons) of various fuels, solvents, and lubricants. Located outside of the storage locker is a 200-gallon tank used to store waste oil.

Located north of the storage locker is the Fueling Station that consists of two (2) 560-gallon tanks containing road diesel fuel and a mobile generator that can be directly connected to one of the diesel fueling tanks. Near the northeast corner of the property at the Wood Chip Dyeing Area, is a 300-gallon tank containing road diesel fuel. A mobile generator powered by diesel fuel is kept at this location and can be directly connected to the diesel fueling tank.

Due east of the Wood Chip Dyeing Area is the Wood Grinding Area. At this location a 517-gallon tank is used to store road diesel fuel that is used for and can be directly connected to one of two wood grinders stationed at the area. A 560-gallon mobile tank is kept nearby along with a diesel-powered generator that connects directly to either of the diesel storage tanks.

The Lubricating Station is located on the southeast end of the property in a horse trailer. The horse trailer houses a compartmentalized storage tank that currently holds up to 100-gallons of waste oil, 100-gallons of hydraulic fluid, 60-gallons of engine oil, and 60-gallons of transmissions fluid in four distinct compartments.

In addition to the petroleum products onsite, waste residue from commercial containers stored onsite and fuel and lubricant drippings from parked heavy equipment could potentially contribute to storm water runoff. Appendix F contains a listing of the types and quantities of material used or stored onsite and each material's potential likelihood of contacting storm water.

3.5 Exposed Significant Materials

The exposed onsite materials are detailed in this section.

3.5.1 Wood Chip Grinding Area

One 560-gallon trailer-mounted mobile storage tank used to fuel heavy equipment is located and kept overnight near the two wood grinders at the Wood Chip Grinding Area. The tank is refueled twice weekly at this location. The diesel tank is surrounded by a steel dike, with a 110% capacity, which is sealed to the tank to prevent rain infiltration. A 517-gallon stationary tank containing diesel fuel is located underneath a wood grinder at the Wood Chip Grinding Area and is connected directly to the wood chipper. The tank is double-walled and has a secondary containment capacity of 564-gallons. A mobile Sullivan-Palatek AC-4 diesel generator is kept at this location and can be directly attached to the diesel storage tanks for fueling. The facility's SPCC plan contains refueling procedures.

3.5.2 Wood Chip Dyeing Area

A 300-gallon AST containing road diesel fuel is located at the Wood Chip Dyeing Area. The tank sits within a steel dike secondary containment that is welded to the tank, preventing any infiltration of rain. The secondary containment has a 110% capacity. Next to the AST is a stationary Kubota KJ-T270FX-60 diesel generator with direct hook-up to the AST. The facility's SPCC plan outlines procedures detailing fuel transfer procedures for the tank and diesel generator.

3.5.3 Fueling Station

Two 560-gallon steel tanks holding diesel fuel are located at the Fueling Station approximately 300 feet north of the office building. Both tanks sit within a steel dike secondary containment that is welded to the tank, preventing any infiltration of rain. Both tanks have a secondary containment capacity of 110%. Just south of the two tanks is a SULLAIR mobile diesel generator that can attach directly to an AST. The facility's SPCC plan outlines procedures detailing fuel transfer procedures for the tanks and diesel generator.

3.5.4 Storage Locker #4

Located 60 feet north of the office building are four storage lockers. The northernmost locker, Storage Locker #4 contains small quantities (<55-gallons) of various fuels, lubricating fluids, hydraulic fluids, and detergents. Storage Locker #4 also has three ASTs located within, including a 350-gallon tank holding A-W46 hydraulic oil, a 222-gallon tank holding engine oil, and 60-gallon tank holding grease for lubricating machinery. Other various fuels and lubricating fluids are located within the storage locker, none totaling over 55-gallons. In the event of a major spill the metal Storage Locker can act as secondary containment when closed. When left open, the Storage Locker will not provide secondary containment to the tanks within so site personnel should be vigilant to ensure that Storage Locker #4 is closed when not in use. When opening Storage Locker #4, site personnel should first check to make sure no petroleum based fluids are leaking from the door. If petroleum bases fluids are leaking from the door to the extent that a spill from one of the interior tanks is probable, than wood fines shall be piled around the door before it is opened to prevent a potential spill from migration. Bags of Automotive Oil Absorbent are located within the Storage Locker to clean up or minimize small to moderate spills. The facility's SPCC plan contains refueling procedures.

Just north of Storage Locker 4, a 200-gallon tank is used to store waste oil. The tank sits within a steel dike, with a capacity of 270-gallons, which provides secondary containment. The diked area is not protected from rainfall. Careful attention is to be paid when draining storm water from the diked area. Oil transfer procedures from the tank are outlined in the facility's SPCC plan.

3.5.5 Lubricating Station

The Lubricating Station is located in a horse trailer on the south end of the property approximately 600 feet southwest from the office building. Located within the horse trailer is a compartmentalized storage tank that holds up to 100-gallons of waste oil, 60-gallons of engine oil, 100-gallons of hydraulic fluid, and 60-gallons of transmission fluid. When closed the horse trailer acts provides secondary containment to the contents of the tank. The horse trailer has a large enough capacity to hold all contents of the compartmentalized storage

tank. When left open, the horse trailer will not provide secondary containment to the tanks within so site personnel should be vigilant to ensure that horse trailer is closed when not in use. When opening the horse trailer, site personnel should first check to make sure no petroleum based fluids are leaking from the door. If petroleum bases fluids are leaking from the door to the extent that a spill from one of the interior tanks is probable, than wood fines shall be piled around the door before it is opened to prevent a potential spill from migration. Automotive Oil Absorbent is kept nearby to clean up or minimize small to moderate spills.

3.5.6 Roll-off Trash Containers

Roll-off trash containers are located a various locations around the site to temporarily store scrap metal and waste produced during site operations. It is recommended that all roll-off containers be equipped with lids, and be kept closed at all times. Leaking roll-off containers without lids can contribute to unwanted storm water pollution. Storm water that ponds in exposed roll-off containers during rainfall events also has the potential of being spilled onsite during unloading and can contribute to unwanted storm water pollution.

3.6 Erosion and Sedimentation

All areas that have been disturbed on-site can contribute to storm water runoff. Disturbed areas are those that have altered the natural landscape and attendant vegetation. Disturbed areas onsite include: compost and wood chip piles, constructed drainage locations, haul roads, parking lots, and lawn areas surrounding support facilities.

3.6.1 Compost and Wood Chip Piles

Located in designated areas around the site are piles of compost and wood chips. Wood chip piles are located on the north end of the site and compost piles are located to the south as designated on the Site Layout found in Appendix B. Runoff from the compost and wood chip piles flows into grass-lined channels described in Section 3.6.2.

3.6.2 Constructed Drainage Locations

Constructed grass-lined drainage ways are located along the west property boundary directing flow from the southwest corner north to Outfall #001. A second grass lined drainage channel is located along the haul road dividing the composting area and the wood chipping area directing flow from east to west, to discharge at Outfall #001. The drainage channels divert all storm water from the site to Outfall #001. Water at Outfall #001 is tested on a quarterly basis for the presence of biological organics and total suspended solids.

The drainage ways are in adequate condition. A check dam equipped with an overflow pipe is located in the west boundary drainage channel to limit flow velocity and to aid the settlement of solids.

3.6.3 Haul Roads

Haul roads lead from the facility entrance to the office and parking areas to the composting and wood chipping areas. The road is paved from the entrance to the office area and around portions of the composting area. The remaining roads are unpaved. Unpaved portions consist of dirt and gravel, as well as rock "flour" from the heavy equipment pulverizing the rock forming the road. Positioning staked straw bales at regular intervals and above culverts can minimize sediment loss from the roads. All roads are in good condition, and the larger rock used for the unpaved roads helps aid in limiting runoff flow velocity. It is recommended that paved haul roads continue to be swept periodically to minimize off-site vehicle tracking of mud from composting and wood chipping activities.

3.6.4 Lawn Areas and Parking Lots

Healthy stands of grass surround the St. Louis Composting, Inc. office building and the associated parking areas to the east. Erosion and sediment runoff are minimal from these areas due to the gentle grading and high water infiltration rate from unpaved gravel roads and compost and wood chip stockpiles during surface water drainage across the site. Periodic monitoring and maintenance will keep these areas in satisfactory condition.

3.6.5 Significant Spills and Leaks

According to the facility's recently revised SPCC plan, dated November 2009, St. Louis Composting, Inc. began operations in March of 1992 as a subcontractor, and took over composting operations at the facility in 1994. There have been no reportable releases of oil products since March 1992.

3.7 Non-Storm Water Discharges

A non-storm water assessment of the National Pollutant Discharge Elimination System (NPDES) outfall monitoring station was conducted on November 14, 2009. The last measurable precipitation event in the Valley Park area was a 2-day event consisting of 2.94 inches of rain on October 26 and 27, 2009.

A no visible flow was seen from Outfall #001 during the assessment. No stains, smudges, odors or fluids were apparent during the non-storm water assessment. Appendix C contains the results of the non-storm water discharge assessment.

3.8 Existing Monitoring Data

Missouri State Operating Permit, General Permit Number MOG970035, is the permit that regulates storm water from the St. Louis Composting, Inc. facility. The permit requires sampling of Outfall #001 during or after a precipitation event no later than one (1) hour after runoff begins on a quarterly basis. Should no discharge occur, a reporting of "no discharge" is allowed. The following parameters must be monitored on a quarterly basis:

- Flow
- Biochemical Oxygen Demand (BOD)
- Total Suspended Solids
- pH – Units

Rainfall shall be monitored daily.

Discharge monitoring reports, analytical data and correspondence related to the permits will be maintained in Appendix D. Appendix E contains the site monitoring and evaluation forms to be used to record visual observations made at the outfall locations.

4.0 BEST MANAGEMENT PRACTICES

The following Best Management Practices (BMP) that shall be followed to comply with the site General Permit:

- Prevent the spillage or loss of fluids, oil grease, fuel, etc. from vehicle maintenance, equipment cleaning, or warehousing activites and prevent the contamination of storm water from these substances.
- Provided for the collection and proper disposal of waste products including, but not limited to, petroleum waste products and solvents. All fueling facilities present on the site shall adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers, and shall include spill prevention, control and counter measures.
- Store all paint, solvents, petroleum products, and petroleum waste products in appropriate storage containers (such as drums, cans, or cartons) so that these materials are safely contained and not exposed to storm water.
- Provide good housekeeping practices on the site to keep trash or other solid waste from entering waters of the state.
- Designate an individual as responsible for environmental matters. Inspect, once per month on workdays, any structure that functions to prevent pollution from storm water or to remove pollutants from storm water. In addition, inspect these structures within 24 hours of each rainfall event of one inch or more. Inspect the facility in general to ensure that any BMP are continually implemented and remain effective.

In addition, the BMPs detailed below shall be practiced to reduce the chances of storm water contamination at the site.

4.1 Good Housekeeping

Good housekeeping practices are common sense practices designed to maintain a clean and orderly work environment. The facility should implement, if not already implemented, the following BMPs to eliminate or minimize storm water pollution:

- Ensure raw materials other than yard waste are not stockpiled for periods greater that 24 hours, as specified in the site's General Permit.
- Ensure the composting mix shall not include more than 5% by volume of animal manure, sludges or similar material. If included, materials should be mixed into the compost piles and should not be stockpiled separately for more than 24 hours, as specified by the site's General Permit

- Maintain dry and clean maintenance shop floors by using brooms, shovels, vacuum cleaners, and other dry cleaning methods. The hosing down of floors will not be done unless absolutely necessary.
- Schedule routine litter and garbage pick-up from maintenance shops and the office.
- Maintain clean yard waste hauling vehicles and equipment in an effort to prevent compost residues from collecting in the parking area.
- Use only biodegradable, non-toxic detergents when washing equipment.
- Commercial trash containers shall be consolidated into one area, if possible, and placed in an upright position with lids closed.
- Puncture and drain used oil filters for 24 hours prior to recycling or disposal. Store in secondary containment area.
- Label all containers showing name and type of substance stored in container.
- Review and encourage good housekeeping practices.

4.2 Preventative Maintenance

The facility should develop and implement a preventative maintenance program that involves inspections and maintenance of storm water devices and routine inspections of facility operations to detect faulty equipment.

- Perform preventative maintenance on storage tanks, valves, pumps, pipes and other equipment.

Sample Preventative Maintenance Reports are found in Appendix E.

4.3 Visual Inspections

Regular visual inspections provide a means to verify that all of the elements of the plan are in place and working properly to prevent contamination of storm water runoff from the facility. Records of all inspections should be kept and consist of the following:

- Complete a monthly inspection of all bulk storage containers holding petroleum products, used filters, solvents, antifreeze, batteries and wastewater for signs of leakage and deterioration.
- Complete a monthly inspection of fuel loading and dispensing areas to ensure that any spillage is promptly cleaned up, and that the necessary equipment and supplies are available for spill response.

- Complete a monthly inspection of equipment parking areas for leaks and spills.

4.4 Spill Prevention and Response

All employees should be aware of response procedures, including material handling and storage requirements. Spills at the St. Louis Composting, Inc. facility are most likely to occur from the following areas:

- Loading and unloading areas for fuel, oils, lubricants;
- Fueling areas;
- Equipment and material storage areas;
- Areas of working equipment (grinders, generators, highlifts);
- Waste handling and storage areas;
- Parking areas; and
- Container storage areas.

To minimize the possibility of a spill and subsequent clean up, the facility should incorporate the following BMPs:

- Ensure that a qualified person remains at the point of fuel transfers to minimize the potential for spillage.
- Ensure that adequate spill response equipment and supplies are available at all fuel transfer locations, and that associates know how to respond to spill situations.
- Provide adequate space to facilitate material transfer and easy access (e.g. fueling heavy equipment).
- Provide secondary containment for fuel storage tanks and used solvents, oils, antifreeze and batteries.
- Store/locate tanks, drums, containers and bags away from direct precipitation and from traffic routes to prevent accidental spills. Provide protection for storage vessels in traffic areas.
- Provide all fuel, chemical, oil, and liquid waste storage tanks with overfill prevention devices, unless filled manually.
- Follow directions given in the Spill Containment section of the current SPCC plan.

Despite the precautions listed above, should a spill occur, response, cleanup, and reporting should be performed in accordance with the SPCC plan. Releases of significant materials should be immediately documented by completing an Incident Report Form found in Appendix H.

4.5 Sediment and Erosion Prevention

Implementation of a sediment and erosion prevention program for the facility can significantly reduce the quantity of runoff from the site. The program should contain the following elements:

- Complete monthly inspection of erosion and sediment control structures. Control structures should additionally be inspected within 72 hours following heavy rains.
- Complete monthly maintenance, including cleaning and repair of erosion and sediment control structures.

The erosion control methods detailed in the sub-parts of this section represent measures that are currently being utilized on the site or measures that could be utilized in future development. The Site Layout Drawing found in Appendix B details the erosion control measure currently being used at the site.

4.5.1 Revegetation

Seeding of areas no longer used in the day-to-day operation of the facility shall occur as soon as reasonably possible. Seeding shall take place during the first available growing season once a disturbed area becomes inactive during optimum planting dates for the particular type of seed being utilized. Inactive areas are those that will not be used for at least six months, such as sideslopes, soil stockpiles, old haul roads, old parking area, and temporary diversion berms.

Prior to seeding, soil testing should be utilized to determine the need for fertilizer, lime and/or organic matter. Soil amendments should be incorporated to a depth of six inches using disk. Following seeding, the areas seeded should be monitored on a monthly basis and after periods of heavy rainfall until grasses are well established. Monitoring frequencies should continue on a quarterly basis thereafter. Should monitoring reveal areas of erosion or slow growth, those areas should be regraded and reseeded. Details of temporary and permanent seeding can be found on pages 35 through 60 of Appendix J.

4.5.2 Mulch

Mulching can be applied to seeded areas to help establish plant cover or may be used to protect against erosion over the winter or until revegatation can be accomplished. Straw or wood cellulose mulch should be crimped, tacked with a liquid tackifier, or covered with anchored netting to hold in place. The area should be regularly monitored for erosion and promptly seeded as described above. Details of mulching can be found on page 61 of Appendix J.

4.5.3 Erosion Control Blankets

For areas needing immediate erosion control, where waiting for revegetation to occur is not an option, erosion control blankets can provide structural erosion control. Netting, biodegradable or permanent blankets or turf reinforcement mat are suitable materials. It is important to anchor the product so that continuous, firm contact with the surface occurs. Monthly monitoring should follow installation. Additional monitoring should occur after periods of heavy rainfall to insure the blankets have not been dislocated or failed.

If erosion control blankets are used on site, materials should be removed after the area has been stabilized and a good stand of vegetation is established. Details for erosion control blankets can be found on page 71 of Appendix J.

4.5.4 Sediment Fence/Straw Bale

Sediment fencing is made of geotextile fabric and acts as a temporary barrier basin for storm water to allow the entrained sediment to settle out. The fabric is attached to supporting posts and staked to the ground. Monitoring should occur weekly and after heavy rainfall events; it should include checking for damage, deterioration, sediment build up, undercutting or sidecutting. The fence should be repaired or replaced, as necessary. Details for sediment fencing and straw bales can be referenced on pages 175 and 183, respectively, in Appendix J.

4.5.5 Grass/Rip-Rap-Lined Channels

These devices handle concentrated surface water runoff to prevent damage from erosion and siltation. Typical uses include roadside ditches, channels at property boundaries, outlets for diversions and stabilizing concentrated flow areas. Rip-rap is suitable for higher flow rates. Side slopes for the drainage should be of structurally sound grade. The channel should be inspected after significant storm events. Accumulations of sediment and debris should be removed. Repairs to grass or rip-rap should be made immediately. Details for grass and rip-rap-lined channels can be found on pages 131 through 138 of Appendix J.

Permanent constructed grass drainage channels are located along the western property line from the southwest end of the property to Outfall #001 and along the haul road separating the wood chipping area and composting area running east to west to Outfall #001. A check dam equipped with an overfill pipe will be placed in the middle of the channel running along the west end of the property. The check dam will serve to decrease flow velocity and allow sediments to settle out of storm water runoff. Check dam and channel locations of shown on the Site Layout Drawing in Appendix B.

4.5.6 Sediment Basins

Sediment basins serve to detain sediment-laden runoff from disturbed areas long enough for the sediment to settle out. This practice is appropriate for areas draining between 10 and 20 acres. The sediment basin shall be sized to contain 0.5 inch of sediment from the drainage area and to be able to contain a 2-year, 24-hour storm or a minimum of 3600 cubic feet of capacity. A registered design professional should design the basin. As with the other methods, monthly monitoring should occur after completion of the basin. Additional monitoring should occur following heavy rainfall events. Sediment that has accumulated in the basin should periodically be removed and properly disposed of. The basin may be used on a temporary or permanent basis. Details for sediment basins can be found on page 209 of Appendix J.

4.5.7 Ditches, Berms and Swales

These diversionary measures should be installed in accordance with engineering specifications. Monthly and post-storm event monitoring should check for channel erosion, overtopping or other damage. Repairs should be completed promptly. Details for temporary and permanent diversionary structures are detailed in pages 107 through 126 of Appendix J.

4.5.8 Buffer Zones

Buffer zones are areas of unmowed grassy vegetation left between areas of sheet runoff and natural drainages. The buffer zones serve to decrease flow velocities. They are well suited for storm water ditches and stream embankments. Details of buffer zones can be found on page 195 of Appendix J.

4.6 Litter

Blowing litter shall be picked up regularly to minimize contact with storm water.

4.7 Haul Roads

Haul roads should be monitored on a monthly basis and following significant precipitation events. Side ditches should be checked for signs of erosion; roads checked for washouts of

gravel surface. Repairs should be made as required. Watering of unpaved roads during dry periods will limit the amount of dust carried to water bodies.

4.8 Drainage Areas

Clearing and grubbing within 50 feet of a defined drainage course should be avoided. Should drainage routes change, clearing and grubbing of new drainage areas should be conducted only after all materials and equipment necessary to protect and complete the drainage change are on-site; changes should be made as quickly as possible. Revegetation of areas impacted by land disturbance should occur as soon as possible. Areas within 50 feet of defined drainage ways should be contoured as needed and revegetated, seeded or otherwise protected within five working days after grading has ceased.

5.0 EMPLOYEE TRAINING

The goals of a training program are to teach personnel the components and procedures of the SWPPP. Employees should gain an overall sensitivity to storm water pollution prevention concerns. Training of employees should, at minimum, occur annually. The training program should cover such topics as spill prevention and response procedures, good housekeeping practices, hazardous material inventory and management processes, and erosion control measure and site specific BMPs. Appendix I contains forms for documenting training and the topics to be covered.

6.0 EVALUATION PHASE

6.1 Periodic Evaluations

Routine inspections will be performed to observe the state of haul roads, slopes, and compost piles. Haul roads, ditches, and easements will be inspected for mud, litter, and other contaminants; slopes and compost piles will be observed for erosion. Weather conditions will be tracked daily to properly prepare for storm events. Routine Inspection Reports are found in Appendix E.

Preventative Maintenance Reports are found in Appendix E. This form should be utilized whenever a storm water control or treatment facility is evaluated. Evaluations should be conducted as noted in Section 4.2 of this document. The identity, description, and status of the facility should be noted, in addition to initial actions taken and follow-up actions necessary.

Appendix E contains Site Monitoring and Evaluation report forms.

The procedures outlined in the facility's SPCC plan should be followed should a petroleum spill occur. The Incident Report Form found in Appendix I should be completed following any spill incident.

6.2 Annual Site Compliance Evaluation

A site compliance evaluation should be completed annually to assess the effectiveness and implementation of BMPs. The following tasks must be completed as part of the evaluation:

- Inspect storm water drainage areas for evidence of pollutants entering the drainage system.
- Evaluate the effectiveness of the BMPs.
- Observe structural measures, sediment controls, and other storm water BMPs to ensure proper operation.
- Revise the plan as needed within 2 weeks of inspection, and implement any necessary changes within 12 weeks of the inspection.
- Prepare a report summarizing inspection results and follow-up actions, identifying the date of inspection and personnel who conducted the inspection.
- Sign the report and keep it with the plan.

The inspection form can be found in Appendix G. This form will be supplemented with a summary report detailing the revisions to the SWPPP. The Site Monitoring and Evaluation Program (Appendix E) will serve as an outline. All reports related to the annual site evaluation should be maintained in Appendix G.

6.3 Recordkeeping and Reporting

Records should be kept of the following items related to the SWPPP:

- Listing of Pollution Prevention Team members and their responsibilities (Appendix A)
- Non-stormwater discharge assessment certification (Appendix C)
- NPDES permit information (Appendix D)
- NPDES outfall testing and laboratory data (Appendix D)
- Periodic site monitoring and evaluation report (Appendix E)
- Preventative maintenance reports (Appendix E)
- Material inventory (Appendix F)
- Annual site compliance evaluations (Appendix G)
- SWPPP review and comment reports (Appendix G)
- Modifications to the SWPPP
- Spills or leaks of significant materials that may have impacted storm water runoff (Appendix H)
- Employee training information (Appendix I)

All records should be maintained by the facility for at least one year after the permit expires.

St. Louis Composting, Inc. must submit an annual report to the Missouri Department of Natural Resources by January 28 of each year for the previous calendar year period. The report shall include information on quantities and types of all raw materials stockpiled or composted during the year; results of any testing performed; quantity of compost sold, disposed or given away; and quantity of composting material on-site at the end of the year.

6.4 Plan Revisions

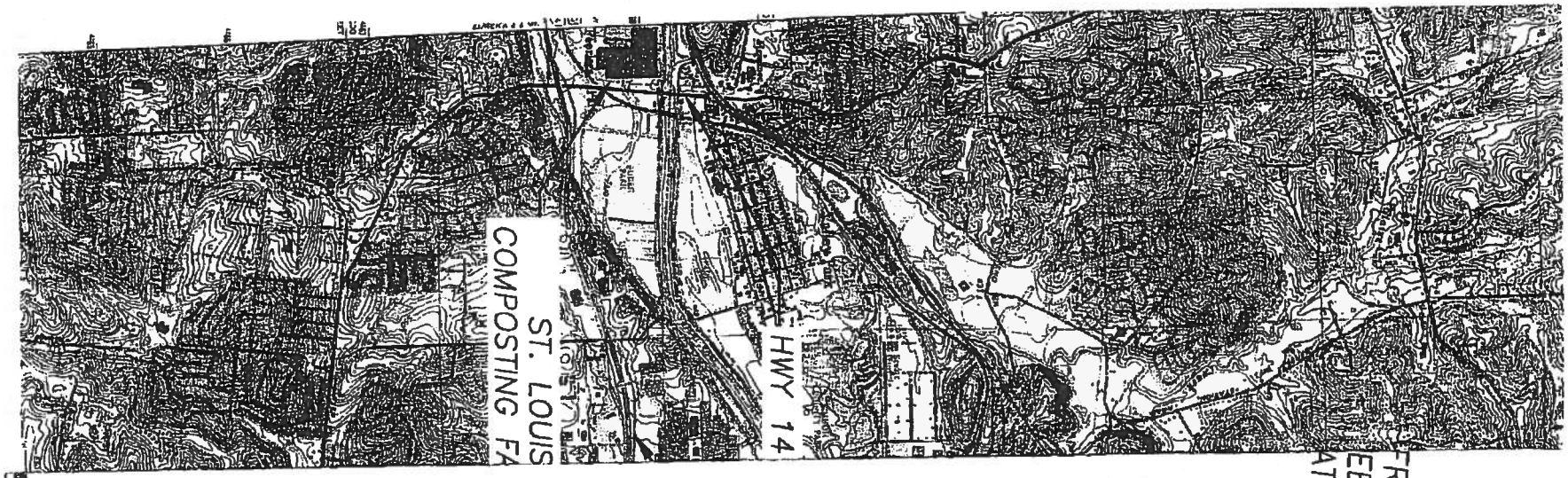
Major changes in a facility's design, construction, operation, or maintenance will necessitate changes in the facility's Storm Water Pollution Prevention Plan.

APPENDIX B

FIGURES

Site Location Map
Site Plan

L:\ST. LOUIS COMPOSTING FA.....\3684.10 VALLEY PARK\SWPPP\APP. B-GIS\FIGURE 1 - SITE LOCATION-STL.DWG



0 4000 8000
FEET

SITE LOCATION
ST. LOUIS COMPOSTING SWPPP

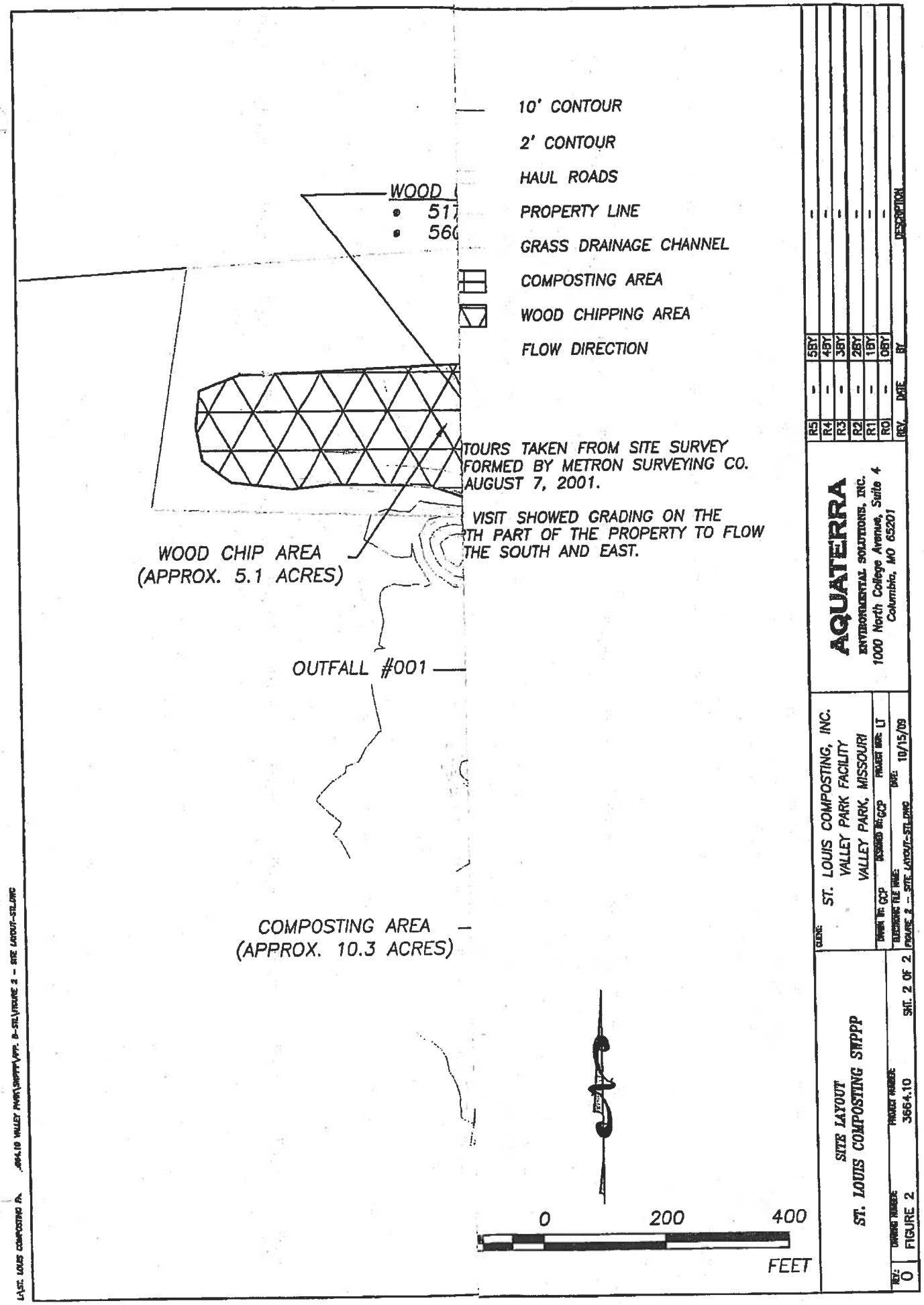
CLIENT: ST. LOUIS COMPOSTING, INC.
VALLEY PARK FACILITY
VALLEY PARK, MISSOURI

DRAWN BY: GCP DESIGNED BY: GCP PROJECT MGR: LT
ELECTRONIC FILE NAME: FIGURE 1 - SITE LOCATION-STL.DWG DATE: 10/15/09

REV:	DRAWING NUMBER:	PROJECT NUMBER:	
0	FIGURE 1	3684.10	SHT. 1 OF 2

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1000 North College Avenue, Suite 4
Columbia, MO 65201

REV.	DATE	BY	DESCRIPTION
R5	-	5BY	-
R4	-	4BY	-
R3	-	3BY	-
R2	-	2BY	-
R1	-	1BY	-
R0	-	0BY	-


10' CONTOUR
2' CONTOUR
HAUL ROADS
PROPERTY LINE
GRASS DRAINAGE CHANNEL
COMPOSTING AREA
WOOD CHIPPING AREA
FLOW DIRECTION
WOOD
517
560
TOURS TAKEN FROM SITE SURVEY
FORMED BY METRON SURVEYING CO.
AUGUST 7, 2001.
VISIT SHOWED GRADING ON THE
TH PART OF THE PROPERTY TO FLOW
THE SOUTH AND EAST.
WOOD CHIP AREA
(APPROX. 5.1 ACRES)
OUTFALL #001
COMPOSTING AREA
(APPROX. 10.3 ACRES)
0
200
400
FEET
R5 - 5BY
R4 - 4BY
R3 - 3BY
R2 - 2BY
R1 - 1BY
R0 - 0BY
REV. DATE BY DESCRIPTION
AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
1000 North College Avenue, Suite 4
Columbia, MO 65201
CLIENT: ST. LOUIS COMPOSTING, INC.
VALLEY PARK FACILITY
VALLEY PARK, MISSOURI
DRAWN BY: GCP DESIGNED BY: GCP PROJECT MGR: LT
DRAWING FILE NAME: FIGURE 2 -- SITE LAYOUT-STL.DWG DATE: 10/15/09
SITE LAYOUT
ST. LOUIS COMPOSTING SWPPP
REV: 0
DRAWING NUMBER: FIGURE 2
PROJECT NUMBER: 3664.10
SHT. 2 OF 2
L:\ST. LOUIS COMPOSTING PA...\3664.10 VALLEY PARK\SWPPP\APP. B-STL\FIGURE 2 - SITE LAYOUT-STL.DWG

APPENDIX C

NON-STORM WATER DISCHARGE ASSESSMENT AND CERTIFICATION

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

NON-STORM WATER DISCHARGE ASSESSMENT AND CERTIFICATION			Completed by: Garrett Prestegard		
			Signature:		
			Date: 11/14/09		
Date of Test or Evaluation	Outfall Directly Observed During the Test	Method Used to Test or Evaluate Discharge	Describe Results from Test for the Presence of Non-Storm Water Discharge	Identify Potential Significant Sources	Name of Person Who Conducted the Test or Evaluation
11/14/09	Outfall #001	Visual	No discharge was observed	None	Garrett Prestegard

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name: Dixie Franklin	B. Title: Compliance Manager
C. Signature:	D. Date:

APPENDIX D

NPDES DOCUMENTATION

General Permit

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. As amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended.

Permit No.:	MOG970035
Owner:	St. Louis Composting, Inc.
Owner's Address:	39 Old Elam, Valley Park, MO 63088
Continuing Authority:	Same As Owner
Continuing Authority Address:	Same As Owner
Facility Name:	St. Louis Composting, Inc.
Facility Address:	39 Old Elam, Valley Park, MO 63088
Legal Description:	Land Grant #1983, St. Louis County
atitude/Longitude:	+3832394/-9029496
eceiving Stream:	Tributary to Meramec River (U)
First Class. & ID#:	Meramec River (P) #2183
USGS & Sub Water ID#:	07140102-080003

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

SIC #2875

All Outfalls: Storm water runoff. Flow is dependent upon precipitation. Yard Waste Composting operations under 20 acres.

This permit authorizes only wastewater, including storm water, discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with RSMo Section 644.051.6 and 621.250, 10 CSR 20-6.020, and 10 CSR 20-1.020.

October 22, 2009
Issue Date

BK

Mark N. Templeton, Director
Department of Natural Resources

November 29, 2012
Expiration Date

Mike Struckhoff, Director, St. Louis Regional Office

APPLICABILITY

1. This permit authorizes the discharge of storm water from yard waste composting operations that are less than 20 acres in size. The acreage is measured by calculating the area that is affected by the composting activities, including unloading, storage, and handling of composting materials and finished compost. It does not include buffer zones, parking lots, maintenance facilities and storm water control basins. Yard waste is defined as those plant waste products that are produced during private, public or commercial lawn care and yard maintenance such as leaves, grass clippings, shrub and tree trimmings, and plant waste from greenhouses, household flower and vegetable gardens.

2. If at any time, the Missouri Department of Natural Resources determines that the quality of waters of the state may be better protected by requiring the owner of yard waste composting operations to apply for an individual Missouri State Operating Permit (MSOP), the Department may do so.

3. If at any time the owner of a yard waste composting operation should desire to apply for an individual MSOP, the owner may do so.

4. This permit does not apply to landfill operations or composting done in association with landfills. This permit does apply to composting operations on landfill property but whose operations are kept wholly separate from landfill operations.

5. This permit does not authorize the discharge of any water other than storm waters.

6. This permit applies to stockpiling of raw materials as necessary for the active production of compost. This permit also applies to the stockpiling of finished composts.

7. This permit does not address the compost quality, distribution, or use of the finished compost.

8. This permit does not authorize composting operations located within 100 feet of a water course, 300 feet of a lake or water supply well, 1,000 feet of a losing stream or sinkhole.

9. This permit does not apply to facilities that would discharge to outstanding national resource or outstanding state resource waters, or their tributaries.

10. Applications for coverage under this general permit for facilities located within the watershed of a 303(d) listed stream shall be evaluated on a case by case basis. Facilities discharging the pollutants for which a stream has been listed as impaired may be required to obtain a site specific permit.

EXEMPTIONS

1. Compost sites which include less than 5% biosolids, septage, or any other form of domestic sewage, are under two (2) acres in size and are operated so as not to discharge are exempt from MSOP requirements [10 CSR 20-6.015(3)(B)7.].

2. Distribution or marketing of composts are exempt from MSOP. The Missouri Fertilizer Law (266.291, RSMo) and the Soil Conditioner Law (266.361, RSMo) may apply to these practices.

3. Uncomposted waste materials that are land applied in normal farming operations are exempt from permitting requirements. This exemption does not apply to stock piles of materials that exceed two (2) acres in size at an operating location.

REQUIREMENTS

1. The permittee shall not stockpile raw materials other than yard waste for periods greater than 24 hours. The composting mix shall not include more than 5% by volume of animal manure, sludges or similar materials. If included, these materials shall be mixed into the compost piles and shall not be stockpiled separately for more than 24 hours.

EQUIREMENTS (continued)

2. Water Quality Standards
   (a) Discharges to waters of the state shall not cause a violation of water quality standards rule under 10 CSR 20-7.031, including both specific and general criteria.
   (b) General Criteria. The following general water quality criteria shall be applicable to all waters of the state at all times including mixing zones. No water contaminant, by itself or in combination with other substances, shall prevent the waters of the state from meeting the following conditions:
      (1) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;
      (2) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;
      (3) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;
      (4) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;
      (5) There shall be no significant human health hazard from incidental contact with the water;
      (6) There shall be no acute toxicity to livestock or wildlife watering;
      (7) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community;
      (8) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.

3. Permittee shall adhere to the following Best Management Practices:
   (a) Prevent the spillage or loss of fluids, oil, grease, fuel, etc. from vehicle maintenance, equipment cleaning, or warehousing activities and prevent the contamination of storm water from these substances.
   (b) Provide for the collection and proper disposal of waste products including, but not limited to, petroleum waste products and solvents. All fueling facilities present on the site shall adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers, and shall include spill prevention, control and counter measures.
   (c) Store all paint, solvents, petroleum products, and petroleum waste products in appropriate storage containers (such as drums, cans, or cartons) so that these materials are safely contained and not exposed to storm water.
   (d) Provide good housekeeping practices on the site to keep trash or other solid waste from entering waters of the state.
   (e) Designate an individual as responsible for environmental matters. Inspect, once per month on workdays, any structure that functions to prevent pollution from storm water or to remove pollutants from storm water. In addition, inspect these structures within 24 hours of each rainfall event of one inch or more. Inspect the facility in general to ensure that any Best Management Practices are continually implemented and remain effective.

4. This permit may be reopened and modified, or alternatively revoked and reissued, to:
   (a) Comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C), and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:
      (1) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
      (2) Controls any pollutant not limited in the permit.
   (b) Incorporate new or modified effluent limitations or other conditions if the results of a waste load allocation study, toxicity test, or other information indicates changes are necessary to assure compliance with Missouri Water Quality Standards.
   (c) Incorporate new or modified effluent limitations or other conditions if, as the result of a watershed analysis, a Total Maximum Daily Load (TMDL) limitation is developed for the receiving waters which are currently included in Missouri's current 303(d) list.

5. All outfalls must be clearly marked in the field.

ANNUAL REPORT

Permittee shall submit an annual report by January 28 of each year for the previous calendar year period. The report shall include information on quantities and types of all raw materials stockpiled or composted during the year; results of any testing performed; quantity of compost sold, disposed or given away; and quantity of composting materials on-site at the end of the year.

PERMIT TRANSFER

This permit may be transferred to a new owner by submitting an "Application for Transfer of Operating Permit" signed by the seller and buyer of the facility, along with the appropriate modification fee.

PERMIT RENEWAL REQUIREMENTS

Unless this permit is terminated, the permittee shall submit an application for the renewal of this permit no later than six (6) months prior to the permit's expiration date.

TERMINATION OF PERMIT

If activities covered by this permit have ceased and this permit no longer applies, the permittee shall request termination of this permit. The permittee shall submit Form H, Termination of a General Permit.

DUTY OF COMPLIANCE

The permittee shall comply with all conditions of this general permit. Any noncompliance with this general permit constitutes a violation of Chapter 644, Missouri Clean Water Law, and 10 CSR 20-6.200. Noncompliance may result in enforcement action, termination of this authorization, or denial of the permittee's request for renewal.

This permit authorizes only the activities described in this permit. Compliance with this permit may not be considered a shield from compliance with any local ordinance, State Regulation or State Law.

PAGE NUMBER 5 of 5

PERMIT NUMBER MO-G970035

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective upon issuance and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
All Outfalls (Note 1)						
Flow	MGD	*		*	once/quarter	24 hr. estimate
Biochemical Oxygen Demand$_5$	mg/L	45		30	once/quarter	grab
Total Suspended Solids	mg/L	100		50	once/quarter	grab
pH – Units	SU	**		**	once/quarter	grab
Rainfall	inches	*		*	daily	total

MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE 10/28/2010. THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Part I STANDARD CONDITIONS DATED October 1, 1980, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780-0018 (8/91)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (continued)

* Monitoring requirement only.

** pH is measured in pH units and is not to be averaged. The pH is limited to the range of 6.5-9.0 pH units.

Note 1 - Monitor once/quarter during the first hour after a discharge from a rainfall event greater than 0.5 inch in a 24 hour period. Report as "no-discharge" if a discharge does not occur during the monitoring period. Samples shall be collected at the property boundary for each storm water discharge point and the sample from each outfall shall be tested separately.

APPENDIX E

EVALUATION REPORTS

Site Monitoring and Evaluation Report
Preventative Maintenance Report

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

STORM WATER POLLUTION PREVENTION PLAN SITE MONITORING AND EVALUATION REPORT

A visual examination should take place on a monthly basis and within 72 hours of a significant rainfall event to assess the condition of the following areas.

Area Inspected	Monitoring Procedure	Comments
Fueling Station	Observe all valves, piping and joints. Is there visible soil contamination? Is there a potential for storm water to contact lubricants, oils, detergents, etc.? Are all secondary containment areas well maintained and properly drained?	
Outside Storage Locker #4	Check the aboveground waste oil tank. Is there visible soil contamination? Are the secondary containment areas well maintained?	
Storage Locker #4	Is there a potential for storm water to contact lubricants, oils, detergents, etc.? Are all secondary containment areas well maintained and properly drained?	
Wood Chip Dyeing Area	Observe all valves, piping and joints. Is there a potential for storm water to contact lubricants, oils, detergents, etc.? Are all secondary containment areas well maintained and properly drained?	
Wood Chip Grinding Area	Observe all valves, piping and joints. Is there a potential for storm water to contact lubricants, oils, detergents, etc.? Are all secondary containment areas well maintained and properly drained?	
Wood Chip Stockpiles and Composting Stockpiles	Check and clear waterways around stockpiles. Check for signs of erosion at the base.	

Lubricating Station	Is there a potential for storm water to contact lubricants, oils, detergents, etc.? Are all secondary containment areas well maintained and properly drained?	
Constructed Drainage System	Check ditches, swales, channels, chutes, and culverts for erosion and sedimentation. Are they free of debris and excessive sediment? Are they sufficiently vegetated?	
Haul Roads	Check the drainage along the road. Is there an adequate crown on the road? Check for unnecessary ponding. Are there any signs of erosion?	
NPDES Outfall Location	Check banks for erosion. Check if vegetative cover appears adequate. Check if the waterway is blocked by natural or artificial obstructions. Check for unusual silt deposits.	
Vehicles and Equipment	Check for levels of oil or fuel and for stains in the parking area. Is the equipment or vehicle included in a preventative maintenance plan?	

Place a checkmark beside every item after inspection of the item is completed and any required actions are noted.

_____ Check all surrounding roads, ditches and easements for mud, litter and other composting related contaminants. Comments

_____

_____

_____Check internal haul roads for litter, mud and other contaminants. Comments _____

_____

_____

_____Walk slopes and around piles of mulch and wood chips and note any observations of the following: erosion, litter, or standing water. Comments _____

_____

_____

_____Evaluate equipment for operational status. Give directions to personnel to initiate appropriate equipment repairs. Comments: _____

_____

_____

Weather

PR24_____INCH, MAX_____F/MIN_____F, SPD_____MPH, WX_____

Observations @ Spirit of St. Louis Airport

I have performed the above inspection to the best of my ability and noted the actions that need to be taken.

Signed:_____

Position:_____

Date:_____

Time:_____

PREVENTATIVE MAINTENANCE REPORT

DATE:

FACILITY: St. Louis Composting

INSPECTION POINT NAME:

DESCRIPTION: (circle)

Control Structure	Potential Spill Area	Treatment System	Material Handling Facility	Other_____

STATUS: (circle)

Working	Dirty	Plugged	Damaged	Spill

Describe:

_____

_____

INITIAL ACTION: (circle)

None	Cleaned	Repaired	Reported	Other

FOLLOW-UP ACTION: (describe)

_____

_____

_____

_____

_____

Inspected by:

Name: _____

Title: _____

Date: _____

Reviewed by:

_____

_____

_____

APPENDIX F

MATERIAL INVENTORY

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

Material Inventory	Completed By: Garrett Prestegard Aquaterra Environmental Solutions, Inc. Date: 10/14/09

Material	Location	Quantity (gals)	Likelihood of Contact with Storm Water	Past Significant Spill or Leak?	
				Yes	No
Diesel	Fueling Station	560	Unlikely due to secondary containment		X
		560	Unlikely due to secondary containment		X
	Wood Chip Dying Area	300	Unlikely due to secondary containment		X
	Wood Chip Grinding Area	517	Unlikely due to secondary containment		X
		560	Unlikely due to secondary containment		X
Used Oil	Storage Locker #4	200	Possible, tanks secondary containment not properly used		X
	Lubricating Station	100	Unlikely due to secondary containment		X
Transmission Fluid	Storage Locker #4	60	Unlikely due to secondary containment		X
	Lubricating Station	60	Unlikely due to secondary containment		X
Hydraulic Oil	Storage Locker #4	350	Unlikely due to secondary containment		X
	Lubricating Station	100	Unlikely due to secondary containment		X
Engine Oil	Storage Locker #4	222	Unlikely due to secondary containment		X
	Lubricating Station	100	Unlikely due to secondary containment		X

APPENDIX G

COMPLIANCE AND REPORTING

Annual Site Compliance Evaluation
SWPPP Review Summary Report

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

ANNUAL SITE COMPLIANCE EVALUATION

This facility will undergo the following review once per fiscal year. Deficiencies will be identified and scheduled for correction.

1. Is the facility's SWPPP on file and available for review? (Y/N)
2. Are all certifications of the SWPPP in place? (Y/N)
3. Have all worksheets been completed and signed? (Y/N)
4. Are BMPs being implemented? (Y/N)
5. Are the BMPs effective? (Y/N)
6. Have training and inspection events been scheduled? (Y/N)
7. Has training been conducted as in accordance with the SWPPP? (Y/N)
8. Have all inspections been conducted as in according to schedule? (Y/N)
9. Are records in place for?:

   Training (Y/N)
   Inspections (Y/N)

10. Have all corrective actions identified as a result of the inspections been completed as scheduled? (Y/N)
11. Has the SWPPP been updated to reflect any changes in the operations or physical changes on-site? (Y/N)

*Follow-up actions_____

_____

_____

_____

Reviewed by:

Name: _____

Title: _____

Date: _____

SWPPP REVIEW REPORT

DATE: _____

ATTENDING: TITLE:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

☐ SWPPP REVIEWED

☐ SITE INSPECTION COMPLETED

☐ REPORTS COMPLETED AND FILED

☐ SWPPP UPDATED AS NECESSARY (Note any changes in the comments section below.)

Comments:

_____

_____

_____

_____

_____

_____

Authorized Representative:

Signature_____ Date_____

Name_____ Title_____

APPENDIX H

INCIDENT REPORT FORM

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

INCIDENT REPORT FORM
ST. LOUIS COMPOSTING, INC.
VALLEY PARK, MISSOURI

1. TIME PROBLEM DISCOVERED _____ DATE _____
2. TIME PROBLEM STOPPED _____ DATE _____
3. APPROXIMATE LOCATION AND TYPE OF ACCIDENT (E.G., FIRE, EXPLOSION, SPILL) _____
4. MATERIAL SPILLED _____
   APPROXIMATE AMOUNT _____
5. EXTENT OF INJURIES (IF ANY) _____
6. WHAT DAMAGE TO PEOPLE OR THE ENVIRONMENT IS LIKELY _____
7. ESTIMATED AMOUNT OF MATERIAL RECOVERED _____
8. WHAT WAS DONE WITH RECOVERED MATERIAL _____
9. ACTION TAKEN TO CONTROL THE PROBLEM AND PREVENT FURTHER PROBLEMS _____

SIGNATURE: _____
TITLE: _____
DATE: _____

APPENDIX I

EMPLOYEE AWARENESS PROGRAM

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

EMPLOYEE AWARENESS PROGRAM

Coordinator: _____ Date: _____

Title: _____

Training Topics	Type of Training Program and/or Material Presented	Training Schedule (Month)	Personnel in Attendance
Components and Goals of SWPPP			
Spill Prevention and Response			
Good Housekeeping			
Preventative Maintenance			
Material Management Practices			
BMPs for Erosion and Sediment Control			

SWPPP ASSOCIATE TRAINING STANDARD

The following items will be reviewed and discussed during training:

1. Material Management Practices. The Materials Inventory found in Appendix F and appropriate storage and handling procedures associated with those materials. If the facility has Employee or Community Right-to-Know training requirements, then this would be an appropriate time to review these also.

2. Spill Prevention and Response. Potential spill areas and drainage routes, including information on past spills and causes. Reporting spills to facility management, agencies and senior management. Implementation of spill response procedures. The facility's SPCC plan should be reviewed.

3. Good Housekeeping. The procedures outlined in Section 4.1 should be reviewed. The location, use and restocking requirements for sweeping brushes, shovels, clean and used spill absorbent, foams and any other spill response equipment on site should be discussed.

4. Preventative Maintenance. The preventative maintenance program and schedule should be reviewed.

5. Best Management Practices. BMPs for sediment and erosion prevention, litter, haul roads and drainage areas should be reviewed.

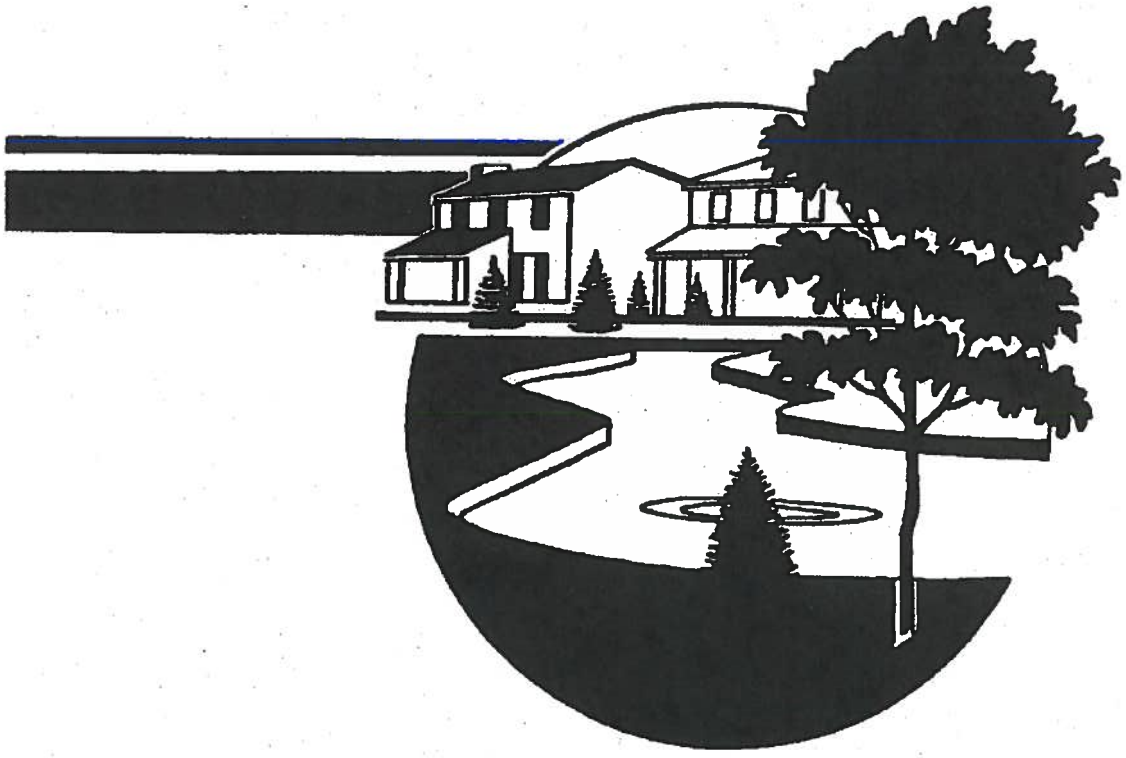
6. Scheduling. Appropriate schedules need to be developed for the various tasks that need to be accomplished to implement the SWPPP and other environmental plans at the site.

APPENDIX J

DETAILED INFORMATION ON BMPS FROM "PROTECTING WATER QUALITY"

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.

Protecting Water Quality



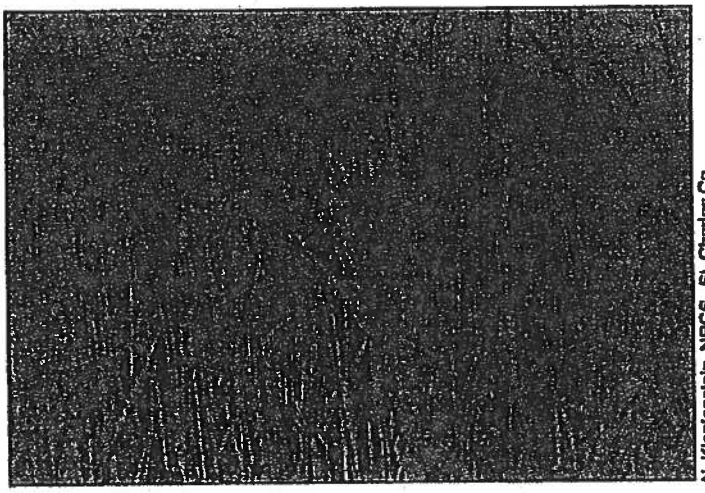
A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri and Kansas

Temporary Seeding

Practice Description

The establishment of fast-growing annual vegetation to provide economical erosion control for up to 12 months and reduce the amount of sediment moving off the site. Annual plants which sprout rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover.

This practice applies where short-lived vegetation can be established before final grading or in a season not suitable for permanent seeding. It helps prevent costly maintenance operations on other erosion control systems such as sediment basin clean-out. Temporary or permanent seeding is necessary to protect earthen structures such as dikes, diversions, and the banks and dams of sediment basins.



Temporary vegetation is a relatively inexpensive way to stabilize construction sites in a hurry. As grass grows, the roots hold soil in place and the plant protects the soil surface from raindrop impacts.

N. Klopfenstein, NRCS, St. Charles Co.

Recommended Minimum Requirements

Prior to start of construction, plant materials, seeding rates and times should be specified by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. To ensure emergence, vigorous growth of seedlings and contin

ued plant growth, prepare seedbed, add lime and fertilizer according to soil tests, mulch all but the most ideal sites and follow seeding dates.

- **Seedbed Preparation:** Loosen soil to depth of 3 inches for broadcast seeding or drilling. If compacted, loosen soils for no till drilling. Avoid excessively wet conditions.
- **Amendments:** Fertilizer and lime (if soil pH is less than 5.3) incorporated 3 to 6 inches into the soil. See Table 5.1.
- **Seed Quality:** Certified seed, tested within the past 9 months
- **Plants:** Recommended temporary erosion control plant species. Rate of application and seeding dates are listed in Tables 5.2 and 5.3.
- **Mulch:** 75% of the ground surface should be covered with approved mulching materials (See *Mulching*). Mulching is critical for the less than ideal situations found on development sites.
- **General:** Inspect seeded areas 2 to 4 weeks after seeding for establishment, erosion control and weed control. Repair and reseed as necessary.
- **Reseed:** After 1 year if site is not in permanent vegetation

Installation

Successful vegetative establishment is directly dependent on the nutrients in the soil. For optimum results, take soil samples from the top 6 inches in each area to be seeded. Submit samples to a soil testing laboratory for liming and fertilizer amendment recommendations.

Seedbed Preparation

Seedbed preparation is essential for the seed to germinate and grow.

For broadcast seeding and drilling, loosen the soil to a depth of approximately 3 inches.

For no-till drilling, the soil surface does not need to be loosened unless the site has surface compaction.

Use a disk, ripper, chisel, harrow or other acceptable tillage equipment to loosen compacted, hard or crusted soil surfaces.

Avoid preparing the seedbed under excessively wet conditions.

Liming

Acid soils with an extremely low pH can prevent seeding success. Most of the recommended temporary vegetation is tolerant of low pH soils and will establish on all but the lowest pH soils.

If soil pH in the region is known to be extremely low, conduct a soil pH test to determine if limestone is necessary for temporary seeding.

Amend soils with lime according to information in Table 5.1.

Soils with a pH above 7.0 should not be limed.

Table 5.1 Liming Requirements for Temporary Sites

pH Test	Plant Response	Recommended Application of Agricultural Limestone
below 6.0	poor growth	lime according to soil test
6.0 - 6.5	adequate growth	no lime recommended
greater than 6.5	greater than 6.5	no lime recommended

Fertilizer

Subsoil will most likely be deficient in nutrients required for growth. A soil test will provide the best guide for the amount and types of fertilizer to apply for optimum plant growth.

A general recommendation is to broadcast 90 lbs. of actual N-P-K per acre for areas receiving more than 30 inches of precipitation and 50 lbs. of N-P-K per acre in areas receiving less than 30 inches of precipitation.*

For best results incorporate the fertilizer into the top 3 to 6 inches before seeding.

* For example, to compute the bulk pounds of product to use

$$\frac{\text{Actual \# Needed}}{\text{\% Available}} \text{ or } \frac{90\#}{28\%} = 321\# \text{ Bulk}$$

Seeding Apply seed evenly with a broadcast seeder, drill, cultipacker seeder or hydroseeder. Plant small grains no more than 1 1/2 inches deep. Plant grasses and legumes no more than 1/2 inch deep.

Prior to mulching, harrow, rake or drag a chain to lightly incorporate broadcast seed and enhance germination. Cover broadcast or drilled seed with mulch (See *Mulching*). On bare soils, firm lightly with a roller or a cultipacker.

Table 5.2 Temporary Seeding Plant Materials and Minimum Seeding Rate *

Species	Seeding Rate		Plant Characteristics
	lbs. per Acre	lbs. per 1,000 ft^2	
Oats	80 lbs	2 lbs	not cold tolerant, height up to 2 feet
Cereals: Rye/Wheat	90 / 120	2.0 / 2.5	cold tolerant, height up to 3 feet, low pH tolerant
Millets, Sudangrass	45 / 60	1.0 / 1.25	warm season annual, aggressive growth, height up to 6 feet
Annual Ryegrass	75	2	may be added to mix, not heat tolerant, height up to 16 inches
Annual Lespedeza ** plus Tall Fescue	15 plus 45	0.5 plus 1.0	warm season annual legume, makes own nitrogen, tolerates low pH

* In areas receiving less than 30 inches of precipitation, use 75 percent of these rates.

** If there is any possibility that the seeding will be required to control erosion for more than one year, then consider the addition of fescue or another permanent species as part of a mixture when seeding.

Planting Dates Plant according to the design plan. In absence of a plan, choose a recommended temporary species or mixture appropriate for the season from Tables 5.2 and 5.3.

Plant during optimum seeding dates if at all possible. Use mulch if planting during acceptable seeding dates. Roll and cultipack broadcast seed for good soil-to-seed contact.

Use high quality seed. For best results use certified seed. When using uncertified seed, use the highest recommended seeding rate.

Table 5.3 Seeding Dates for Temporary Seedings

Species	Seeding Dates Optimum & Acceptable											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oats		■	■	■	■			■	■			
Cereals: Rye/Wheat	■	■	■	■	■			■	■	■		
Millets, Sudangrass					■	■	■	■				
Annual Ryegrass	■	■	■	■	■			■	■			
Annual Lespedeza plus Tall Fescue [1]	■	■	■	■	■							

1 If site may not be developed within one year, consider permanent species listed in Table 5.8.

Table Key:

Optimum Seeding Dates	■
Acceptable Seeding Dates	■

Mulching Mulching is recommended to conserve moisture and reduce erosion.

Evenly cover 75% of the ground surface with mulch material specified in the design plan. Tack or tie down according to plan (See *Mulching*).

Construction Verification Check materials and installation for compliance with specifications.

Troubleshooting Consult with a qualified design professional if the following occurs:

- Design specifications for seed variety, seeding dates or mulching cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Maintenance Check temporary seedings within 2 to 4 weeks of planting to see if stands are of adequate thickness (more than 30% of the ground surface covered). Stands should be uniform and dense for best results. Fertilize, reseed and mulch bare and sparse areas immediately to prevent erosion.

Mowing is not recommended for cereals seeded alone. Cereals seeded with a grass can be mowed when height is greater than 12 inches. However, to prevent damage to grasses, do not mow shorter than 4 inches.

Millets and sudangrass should be mowed before height is greater than 6 inches to allow regrowth and continued erosion protection.

Annual lespedeza and tall fescue may be mowed after height exceeds 8 inches. Do not mow shorter than 4 inches.

Replant temporary or permanent vegetation within 12 months as annual plants die off and no longer provide erosion control (see *Permanent Seeding*). Consider no-till planting where possible.

Common Problems Inadequate seedbed preparation; causes poor seedling emergence and growth—repair gullies, prepare seedbed, fertilize, lime (if necessary), mulch and reseed.

Unsuitable choice of plant materials; resulting in poor germination or inadequate stand (less than 30% of the ground surface covered)—choose plant materials appropriate for season, prepare seedbed and replant.

Inadequate mulching; resulting in poor or spotty stands—cover area evenly and tack or tie down mulch properly, especially on slopes, ridges and in channels.

Lack of nitrogen; causes poor plant vigor, yellow color and short height—add 50 lbs. of nitrogen fertilizer per acre. Do not apply over the top of existing plants from June 1 to August 15 or on frozen ground.

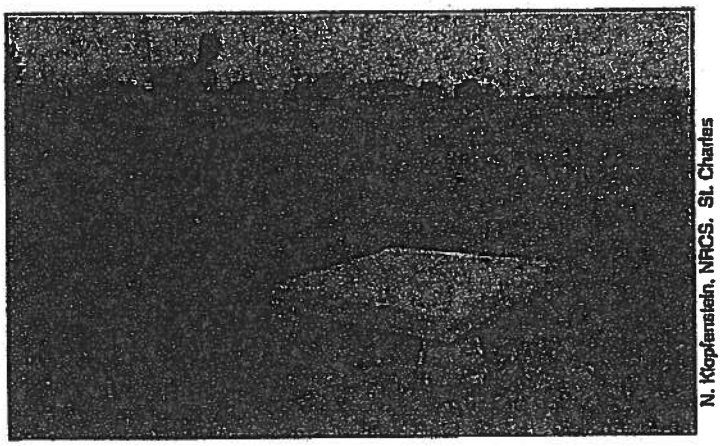
Dying plants; usually caused by soil compaction that limits root growth and water availability to plants—loosen soil if reseeding is necessary or before seeding permanent vegetation.

Temporary Seeding _____

Permanent Seeding

Practice Description

The establishment of perennial vegetation on disturbed areas for periods longer than 12 months. Permanent vegetation provides economical long-term erosion control and helps prevent sediment from leaving the site. This practice is used when vegetation is desired to permanently stabilize the soil. It is necessary to protect earthen structures such as dikes, channels and embankments. Particular care is required to establish a good, thick cover of permanent grass.



N. Klopfenstein, NRCS, St. Charles

Permanent vegetation can be used to stabilize many structures, such as this grassed waterway, ensuring that runoff is relatively sediment-free.

Recommended Minimum Requirements

Prior to start of construction, plant materials, seeding rates and times should be specified by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. To ensure germination and growth, prepare seedbed, add lime and fertilizer according to soil tests, mulch all but the most ideal sites and follow seeding dates.

- **Seedbed Preparation:** For broadcast seeding or drilling, loosen soil to depth of 3 inches. For no till drilling, loosen soil if it's compacted. Avoid excessively wet conditions.

- **Soil Amendments:** Fertilizer and lime (if soil pH is less than 6.0) incorporated 3 to 6 inches into the soil
- **Seed Quality:** Certified seed, tested within the past 9 months
- **Planting Dates:** Appropriate for region and species (See Table 5.4)
- **Plants:** Recommended erosion control plants (grass or grass/legume mixtures) as shown in Tables 5.5 and 5.6. Rate of application and seeding dates are shown in Tables 5.4, 5.7 and 5.8.
- **Mulch:** 75% of the ground surface covered with approved material (See *Mulching*)
- **Inspection:** Inspect seeded areas 4 to 6 weeks after seeding. Repair and reseed as necessary.

Installation

During final grading, take soil samples from the top 6 inches in each area to be seeded. Submit sample to a soil testing laboratory for liming and fertilizer recommendations.

Seedbed Preparation

Seedbed preparation is essential for the seed to germinate and grow.

For broadcast seeding and drilling, loosen the soil to a depth of approximately 3 inches.

For no-till drilling, the soil surface does not need to be loosened unless the site has surface compaction.

Loosen compacted, hard or crusted soil surfaces with a disk, ripper, chisel, harrow or other tillage equipment.

Avoid preparing the seedbed under excessively wet conditions.

Liming Follow the design plan. Apply ground agricultural limestone unless a soil test shows a pH of 6.5 or greater.

If a soil test or plan is not available, use 2 tons of ground agricultural lime.

Incorporate lime into the top 3 to 6 inches of soil.

Fertilizer For establishment and long-term growth, apply a complete fertilizer at rates recommended by soil tests or as specified in the design plan. In the absence of soil tests, use the following as a guide:

Cool Season Grasses: Apply 90–90–90 N–P–K if rainfall exceeds 30 inches per year. Apply 50–50–50 N–P–K if rainfall is less than 30 inches per year.

Cool Season Grass/Legume Mixtures: Apply 60–90–90 N–P–K.

Warm Season Grasses: Apply 0–60–30 N–P–K.

Cool/Warm Season Grass Mixtures: Apply 30–60–30 N–P–K.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

Incorporate lime and fertilizer to a depth of 3 to 6 inches by disking or chiseling on slopes of up to 3:1.

Grade soil to a smooth firm surface to enhance rooting of seedlings and reduce rill erosion.

Plant Selection If not specified in the design plan, choose a suitable species of grass or a grass/legume mixture from Tables 5.5 and 5.6 appropriate for the season (Table 5.4). Consider site conditions including soils, plant characteristics, region of the state and desired level of maintenance. The species shown are adapted for lawns and erosion control. If there are

questions on species selection and how they may be adapted in wildlife habitat or wetland applications, contact your local NRCS or Extension office.

Developing a Mixture

A pure stand of grass provides the best erosion control. The advantage of a grass/legume mix is that the legume provides nitrogen to the grass and often grows during hotter and drier months when the grass is dormant. Usually one grass and one or two legumes is sufficient in a mixture. More grasses can be mixed together, but may be of little use. Refer to Tables 5.5 and 5.6 for information about each grass and legume to determine the correct species for your site.

Nurse Crops

Nurse crops such as wheat, rye and oats are sometimes used in a seeding mixture. These winter annuals can reduce weeds, control erosion and provide winter protection to young seedlings.

Plant nurse crops about 1 inch deep. Most permanent grasses and legumes are sown 1/4 inch deep. Permanent seedings should not be planted deeper than 1/4 to 1/2 inch.

Aesthetic Plantings

A wide variety of native forbs and grasses are available that add diversity and beauty to permanent plantings (i.e., switchgrass as an accent). Contact your local NRCS office for species selection and seeding rates.

Planting Dates

If seeding dates are not specified in the design plan, use the seeding calendar shown in Table 5.4.

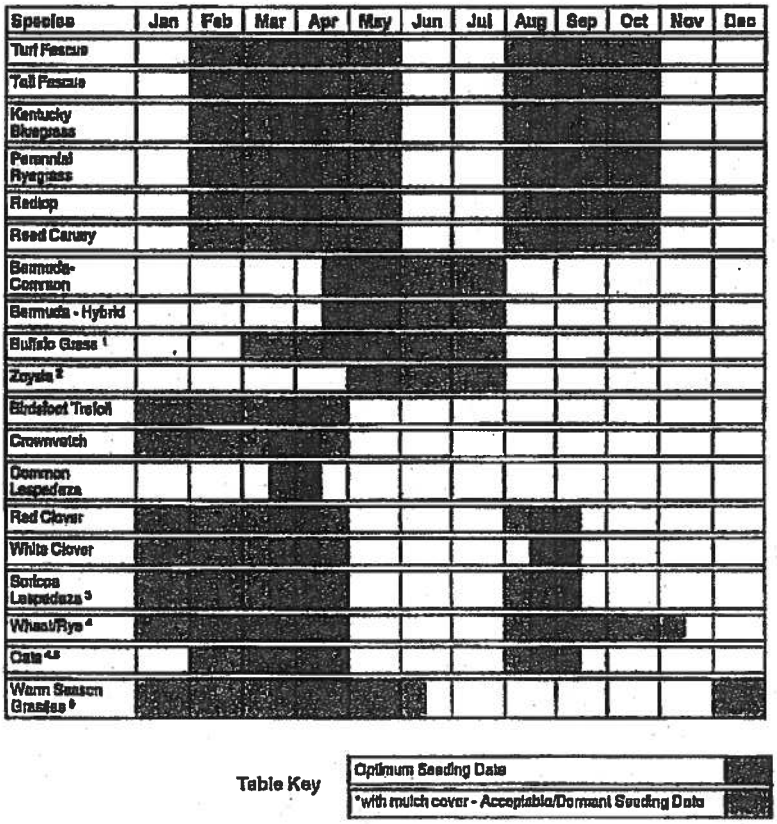
Plant during optimum seeding dates if at all possible. Use mulch if planting during acceptable or dormant seeding dates. For dormant seeding dates, broadcast seed and immediately roll and cultipack for good soil-to-seed contact.

If unable to seed according to schedule, use temporary seeding until preferred date for permanent seeding.

Seeding Rates

If seeding rates are not specified in the design plan, use rates in Table 5.7 for grasses alone. Use rates in Table 5.8 for a grass/legume mixture. These rates are based on the poor growing conditions that typically exist on a development site, a need for dense growth and high germination rates.

Table 5.4 Planting Dates
Optimum and Acceptable* Planting Dates



1 Can also be sprigged.
2 Usually sprigged. Space plugs every 6, 8 or 12 inches; with 4,000, 2,250 or 1,000 sprigs/1000 ft² respectively.
3 Check with your local Noxious Weed Department before planting.
4 Nurse crop only.
5 Provides a quick temporary cover or nurse crop even if planted in the fall.
6 Mulch areas.

Table 6.5 Plant Characteristics

Species		Kansas Adaptation	Missouri Adaptation	Maintenance	Fertility Needs	Establishment Ease
				L-M-H [1]	L-M-H [1]	P-M-G [2]
Cool Season Grasses	Perennial ryegrass	E, C, W *	N, S	L	M	M
	Canada wildrye	E, C, W	N, S	M	L	G
	Tall fescue	E, C, W *	N, S	M	L-H	G
	Crested wheatgrass	E, C, W	N	M	L	M-G
	Kentucky bluegrass	E, C, W *	N, S	H	M-H [3]	M-G
	Bromegrass	E, C, W *	N, S	M	M-H [3]	M-G
	Redtop	S½ E	N, S	L	L	M
	Reed canary [4]	E, C, W *	N, S	H	L-M [5]	P
Warm Season Grasses	Common Bermuda	S½ E, C	S	L	L-M	M
	Hybrid Bermuda	S½ E, C	-	L	L-M	M
	Buffalograss [6]	E, C, W	N, S	L	L	M
	Blue grama	E, C, W	N, S	L	L	M
	Zoysia [7]	S½ E,C	-	M	M-H	M
	Sideoats grama	E, C, W	N, S	M	L	G
	Little bluestem	E, C, W	N, S	M	L	M
	Big bluestem	E, C, W	N, S	M	L	M
	Indiangrass	E, C, W	N, S	M	L	M
	Switchgrass	E,C,W	N, S	M	L	M
Legumes [8]	Birdsfoot trefoil	E, C *, W *	N, S	L	M	P-M
	Crownvetch	E, C, W	N, S	M	M	P-M
	Annual lespedeza [9]	E, C, W *	N, S	M	M	P-M
	Red clover	E, C *, W *	N, S	M	M	G
	White clover	E, C *, W *	N, S	L	L	M-G
	Alfalfa	E, C *, W *	N, S	M	M	P
Companion Crops/Cereal Grains	Wheat				M	M
	Rye (cereal)				M	M
	Oats				M	M

* Adaptation limited to areas which receive additional moisture enhancement by irrigation, subirrigation or overland flow.

1 L = low, M = moderate, H = high
2 P = poor, M = moderate, G = good
3 Will be high maintenance in lawn-type or low rainfall (<30") settings.
4 Adapted to shorelines, wet or frequently flooded areas.
5 Responds well to fertilizer, but doesn't necessarily require it.
6 Usually seeded, but can be sprigged.
7 Usually sprigged, plugged or sodded.
8 Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.
9 Will reseed each year if not mowed until after seed shatter in September.

Table 5.6 Species Tolerance for Environmental Conditions

Species		Tolerance				
		Shade	Drought	Flooding	Traffic	Soil Wetness
		L-M-H				P-M-G
Cool Season Grasses	Perennial ryegrass	L	L	M	M	M
	Canada wildrye	M	M	L	M	P
	Tall fescue	M	M	M	M	P
	Crested wheatgrass	L	H	M	M	G
	Kentucky bluegrass	L	L	M	H	G
	Bromegrass	L	M	L	H	M
	Redtop	L	L	M	H	G
	Reed canary	L	M	H	H	G
Warm Season Grasses	Common Bermuda	L	H	H	H	M
	Hybrid Bermuda	L	H	H	H	M
	Buffalograss	L	H	H	H	G
	Blue grama	L	H	L	M	P
	Zoysia	L	H	M	H	P
	Sideoats grama	L	H	M	H	M
	Little bluestem	L	H	L	L	P
	Big bluestem	L	H	M	L	M
	Indiangrass	L	M	L	M	P
	Switchgrass	L	M	M	M	G
Legumes[1]	Birdsfoot trefoil	L	H	L	M	G
	Crownvetch	L	H	M	H	M
	Annual lespedeza	L	L	M	L	M
	Red clover	L	L	L	M	P
	White clover	L	L	L	H	M
	Alfalfa	L	L	L	L	P

Key: P = Poor, L = Low, M = Moderate, G = Good, H = High

1 Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.

Table 5.7 Seeding Rates

Species		Kansas: Full Seeding Rate[1] lbs./acre (PLS)[2]	Missouri: Full Seeding Rate[1] lbs./acre (PLS)[2]
Cool Season Grasses	Perennial rye	80	80
	Canada wildrye	21	24
	Tall fescue	80	80
	Crested wheatgrass	20	16
	Kentucky bluegrass	50	50
	Bromegrass	100	100
	Redtop	8	8
	Reed canary	40	40
Warm Season Grasses	Common Bermuda	2	4
	Hybrid Bermuda	20 bu./acre	–
	Buffalograss	8 (grain)	8 (grain)
	Blue grama	3	6
	Zoysia	20 bu./acre	–
	Sideoats grama	15	15
	Little bluestem	9	13
	Big bluestem	17	16
	Indiangrass	12.5	16
	Switchgrass	8	9
Legumes[3]	Birdsfoot trefoil	5	10
	Crownvetch	16	16
	Annual lespedeza	14	16
	Red clover	8	12
	White clover	3	4
	Alfalfa	9	9
Companion Crops	Wheat	1 bu./acre	1 bu./acre
	Rye (cereal)	1 bu./acre	1 bu./acre
	Oats	1½ bu./acre	1½ bu./acre

1 Note: Rates based on typical construction site conditions where seedbed is normally less than ideal. Planned future use or specific site conditions may dictate an increase or a decrease in rates. Contact your local NRCS office or consulting agronomist for specific seeding rates within your county.

2 PLS or Pure Live Seed = the amount of seed guaranteed to grow. (See note on page 51.)

3 Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.

Table 5.8. Example Seeding Mixtures for Critical Area Seedings

Grass-Legume Mixture	Seeding Rate (PLS) *	
	lbs. / 1000 ft ^{2} ***	lbs. / acre
Reed Canarygrass / White Clover	5 + 0.1	40 + 1
Reed Canarygrass / Red Clover	5 + ¼	40 + 2
Tall Fescue** / Birdsfoot Trefoil	10 + ¼	80 + 2
Tall Fescue** / White Clover	10 + 0.1	80 + 1
Tall Fescue** / Lespedeza	10 + ½	80 + 4
Tall Fescue** / Lespedeza / White Clover	10 + ½ + 0.1	80 + 4 + 1
Tall Fescue** / Red Clover	10 + ¼	80 + 2
Tall Fescue** / Red Clover / White Clover	10 + ¼ + 0.1	80 + 2 + 1
Kentucky Bluegrass / White Clover	3 + 0.1	25 + 1
Kentucky Bluegrass / Red Clover	3 + ¼	25 + 2
Kentucky Bluegrass / Birdsfoot Trefoil	3 + ¼	25 + 2
Kentucky Bluegrass / Lespedeza	3 + ½	25 + 4
Perennial Ryegrass / Red Clover	8 + 1	70 + 10
Perennial Ryegrass / Birdsfoot Trefoil	8 + ½	70 + 5
Perennial Ryegrass / Lespedeza	8 + 3	70 + 25
Big Bluestem / Indiangrass / Switchgrass / Sideoats grama / Western Wheatgrass	—	3.4 + 2.5 + 2 + 3 + 4
Wheat/Rye (as nursery crop)	1.5	60
Oats (as nursery crop)	0.75	30

* PLS or Pure Live Seed = the amount of seed guaranteed to grow. To calculate amount of bulk seed needed: Read seed tag and multiply % purity X % germination = % PLS; then divide lbs of PLS recommended by % PLS. Example: 30 lbs of Reed canary is needed to seed a 1 acre waterway; 90% pure X 90% germination = 81% PLS; 30 lbs PLS / .81 = 37 lbs. bulk seed needed.

** Turf fescue may be substituted for fescue at the same rates.

***Note: Use lbs. / 1000 ft.^{2} rate to establish dense vegetation for lawns.

Seeding Rates *(continued)* For best results use certified seed. When using uncertified seed, use the highest recommended seeding rate. Higher seeding rates will not substitute for good seedbed preparation.

Seeding Apply seed uniformly using a cyclone seeder, drop-type spreader, drill, cultipacker seeder or hydroseeder.

When using a drill seeder, plant rye or other grains about 1 inch deep; plant grasses and legumes no more than 1/2 inch. Calibrate equipment in the field.

Cover seed by raking, or dragging a chain, brush or mat. Then firm the soil lightly with a roller. Seed can also be covered with hydro-mulched wood fiber and tackifier.

Legumes Legumes require inoculation with nitrogen-fixing bacteria to ensure good growth. Purchase inoculum from seed dealer and mix with seed prior to planting.

Mulching Mulching is recommended to conserve moisture and reduce erosion.

Cover at least 75% of the area with approved mulch materials. Crimp, tack or tie down mulch with netting. Mulching is extremely important for successful seeding (See *Mulching*).

Construction Verification Check materials and installation for compliance with specifications.

Troubleshooting Consult with design professional if the following occurs:

- Design specifications for seed variety, seeding dates or mulching cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Maintenance Expect emergence of grasses within 4 to 28 days and legumes 5 to 28 days after seeding, with legumes following grasses.

Check permanent seedings within 4 to 6 weeks after planting. Look for:

- Vigorous seedlings;
- Uniform density with at least 30% of the ground surface covered;
- Uniformity with nurse plants, legumes and grasses well intermixed; and
- Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.

Reseeding Inspect seedings for erosion or die out for at least a year. To repair bare and sparse areas, fill gullies, refertilize, reseed and mulch. Consider no-till planting where possible.

If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action: choice of plant materials, lime and fertilizer quantities, poor seedbed preparation or weather. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.

Depending on stand conditions, repair with complete seedbed preparation, then overseed or reseed.

If it's the wrong time of year to plant desired species, overseed with cereal grain or millets to thicken the stand until timing is right to plant perennials or use temporary seeding.

Fertilization Satisfactory establishment may require refertilizing the stand in the second growing season.

- Do not fertilize cool season grasses in late May through July.
- Grass that looks yellow may be nitrogen deficient. An application of 50 lbs of N-P-K per acre in early spring will help cool season grasses compete against weeds or grow more successfully.

Remember to convert actual pounds of nutrient needed when determining how many pounds of commercial fertilizer to buy.

- Do not use nitrogen fertilizer if stand contains more than 20% legumes.

Mowing Consider mowing after plants reach a height of 6 to 8 inches.

Mow grasses tall, at least 3 inches in height and minimize compaction during mowing process.

Monitor the late winter and early spring growth of nurse crops to be sure that they do not smother the permanent seeding. Mowing in April may reduce the competitiveness of the nurse crop and open the canopy to allow more sunlight to permanent seedlings that are beginning to grow.

Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading.

Common Problems Inadequate seedbed preparation; results in poor stand—prepare well-tilled, limed and fertilized seedbed and reseed.

Unsuitable choice of plant materials such as seeding Bermuda grass in the north or in the fall; results in stand failure—select an appropriate species based on plant characteristics in Tables 5.5 and 5.6 and time of seeding (Table 5.4).

Nurse crop rate too high in mixture; results in perennial being outcompeted—limit rates to those shown in Table 5.8; eliminate old nurse crop, prepare seedbed and reseed.

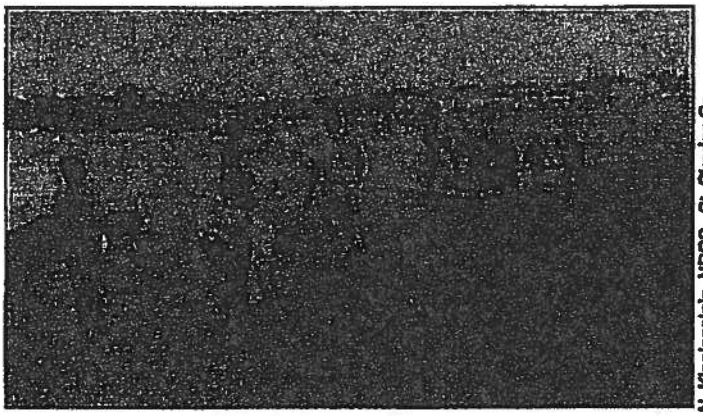
Seeding at the wrong time of the year; resulting in inadequate stand—consult Table 5.4 and reseed. If timing is not right, use temporary seeding to stabilize soil until preferred seeding dates.

Inadequate mulching; results in inadequate stand, bare spots or eroded areas—prepare seedbed, reseed, cover seed evenly and tack or tie down mulch, especially on slopes, ridges and in channels (see *Mulching*).

Sodding

Practice Description

The use of a vegetative cover to provide immediate erosion control in disturbed areas. Sodding is well suited for stabilizing erodible areas such as grass-lined channels, stormwater detention basins, diversions, swales, slopes and filter strips.



N. Klopfenstein, NRCS, St. Charles Co.

To prevent roots from drying out, moisten soil surface and butt sod joints tightly against each other.

Recommended Minimum Requirements

Prior to start of installation, plant materials and amendments should be specified by a qualified professional. Plans and specifications should be referred to by field personnel throughout the installation process.

- **Plant Selection:** High quality, healthy, moist, fresh sod. Select a variety that is well-adapted to the region, intended use and desired level of maintenance. (See Table 5.9)
- **Soil Amendments:** Fertilizer and lime (if soil pH is less than 6.0) incorporated to a depth of 3 to 6 inches into the soil
- **Soil Surface:** Clear of clods, rocks, etc.; smooth and firm; not compacted clay or pesticide-treated soil
- **Irrigation:** Required to ensure rooting
- **Timing:** Anytime of the year, except when the soil is frozen

Installation

Soil supplied nutrients are critical to sod establishment and continued plant growth. Test soil for nutrients and pH. Soil testing can be done at University Extension offices and private labs.

Site Preparation

Apply amendments according to soil test recommendations. In the absence of a soil analysis, apply fertilizer amendments at the following maximum rates:

Fertilizer: 90-90-90 N-P-K per acre or consult sod sales person

Apply ground agricultural limestone unless a soil test shows a pH of 6.0 or greater. If soil test recommendations are not available and soil pH is less than 6.0, use:

Ground agricultural limestone: 20 lbs ENM or ECC* /1000 ft^2 or 800 lbs ENM or ECC* /acre (approx. 2 tons/acre)

Incorporate amendments to depth of 4 to 6 inches with a disk or chisel plow.

Rake or harrow to achieve a smooth, final grade on which to lay the sod. Surface should be loose, and free of plants, trash and other debris.

Table 5.9 Sod Species Adaptation to Regions of the State

Species	Kansas	Missouri
Kentucky Bluegrass	East and Central	Statewide
Turf Fescue	East and Central	Statewide
Bermuda		
common	South half, east, central	Southern half
improved	South half, east, central	Southern third
Zoysia	South half, east, central	Southern half
Buffalograss	Statewide	Statewide

Laying Sod

Sod should not be laid on soil surfaces that are frozen.

* Missouri state agricultural lime laws require that ag lime be sold as units of Equivalent Neutralizing Material (ENM)/ton. For example, soil test requires 800 lbs ENM and lime producer's material tests at 400 lbs ENM. 800 ÷ 400 = 2 tons to be applied. See MU Guide #9107 for details. In Kansas, ECC (Effective Calcium Carbonate) = ENM. (See *Glossary* for definition.)

During high temperatures, moisten the soil immediately prior to laying sod. This cools the soil and reduces root burning and dieback.

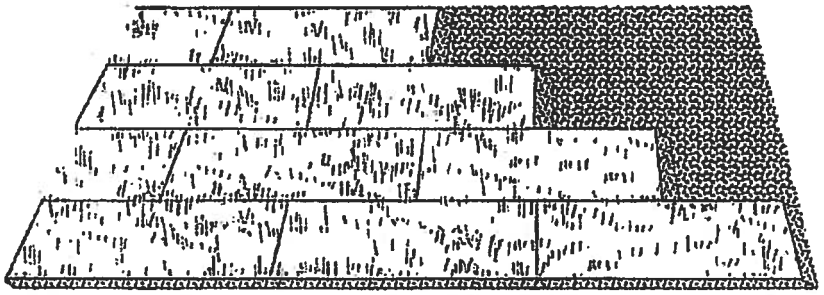
Lay the first row of sod in a straight line with subsequent rows placed parallel to and butting tightly against each other. Stagger joints to create a brick-like pattern and promote more uniform growth and strength. Ensure that sod is not stretched or overlapped and that all joints are butted tight to prevent spaces which would cause drying of the roots. (See Figure 5.2).

On slopes 3:1 or steeper, or wherever erosion may be a problem, lay sod with staggered joints and secure by stapling or pegging. Install sod with the length perpendicular to the water flow (on the contour).

Immediately after laying the sod, roll or tamp it to provide firm contact between roots and soil, then irrigate sod deeply so that the underside of the sod pad and the soil 4 inches below the sod is thoroughly wet.

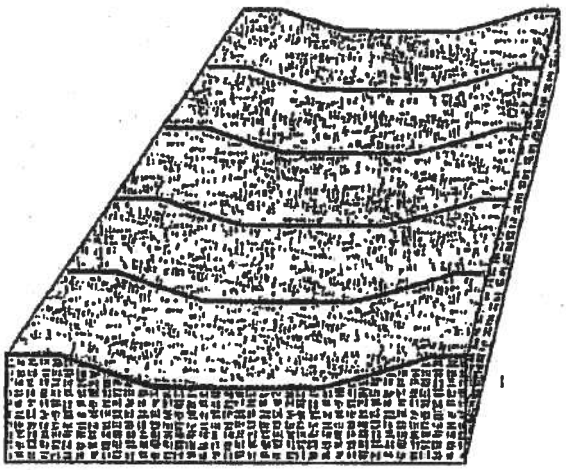
Until a good root system develops, water sod during dry periods as often as necessary to maintain moist soil to a depth of at least 4 inches.

Wait until the sod is firmly rooted before mowing for the first time, usually 2 to 3 weeks. Not more than 1/3 of the grass leaf should be removed at any one cutting.



Lay sod in a staggered pattern with strips butted tightly against each other.

Figure 5.2 Typical installation of grass sod



Lay sod across the direction of flow. Use pegs or staples to fasten sod firmly at the corners and in the center.

Figure 5.3 Installation of Sod in Waterways

Sodded Waterways

Sod provides quicker protection than seeding and may reduce the risk of early washout unless fiber blankets are used.

When installing sod in waterways, use the type of sod specified in the channel design.

Lay sod strips perpendicular to the direction of water flow and stagger in a brick-like pattern. See Figure 5.3.

Staple firmly at the corners and middle of each strip. Jute or synthetic netting may be pegged over the sod for further protection against washout during establishment.

Construction Verification

Check materials and installation for compliance with specifications.

Troubleshooting

Consult with qualified design professional if any of the following occur:

- Variations in topography on site indicate the sodding materials will not function as intended; changes in plan may be needed.
- Design specifications for sod variety cannot be met or irrigation is not possible; substitution or seeding may be required. Unapproved substitutions could result in erosion or sodding failure.

Maintenance

Keep sod moist until it is fully rooted.

Mow to a height of 2 to 3 inches after sod is well-rooted, in 2 to 3 weeks. Do not remove more than 1/3 of the leaf blade in any mowing.

Permanent, fine turf areas require yearly fertilization. Fertilize warm-season grass in late spring to early summer; cool-season grass in late winter and again in early fall.

Common Problems

Sod laid on poorly prepared soil or unsuitable surface; grass dies because it is unable to root—remove dead sod, prepare surface and resod.

Sod not adequately irrigated after installation; may cause root dieback or grass does not root rapidly and is subject to drying out—irrigate sod and underlying soil to a depth of 4 inches and keep moist until roots are established.

Sod not anchored properly; may be loosened by runoff—replace damaged areas and anchor sod.

Slow growth due to lack of nitrogen; may cause yellowing of leaf blades—refertilize sod, but avoid fertilizing cool season grasses from late May through July.

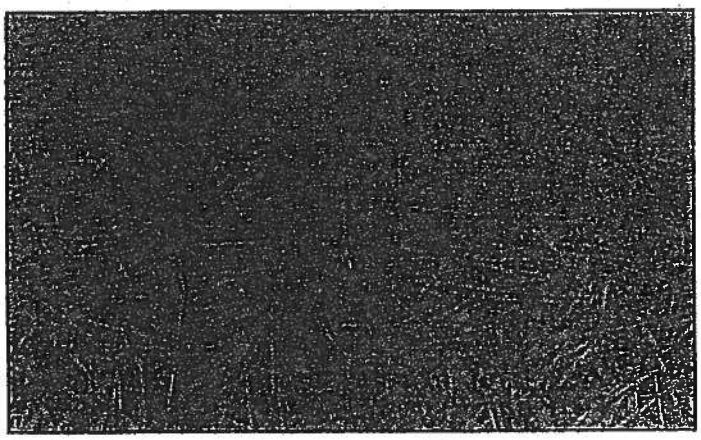
Sodding

Mulching

Practice Description

The application of plant residues such as straw or other suitable materials to the soil surface. Mulch protects the soil surface from the erosive force of raindrop impact and reduces the velocity of overland flow. It helps seedlings germinate and grow by conserving moisture, protecting against temperature extremes and controlling weeds. Mulch also maintains the infiltration capacity of the soil.

Mulch can be applied to seeded areas to help establish plant cover. It can also be used in unseeded areas to protect against erosion over the winter or until final grading and shaping can be accomplished.



N. Klopfenstein, NRCS, St. Charles Co.

It takes about two tons per acre of straw mulch to cover at least 75 percent of the ground surface. To prevent erosion and provide the best microclimate for seed establishment, straw mulch should be physically anchored or tied down with a tackifier.

Recommended Minimum Requirements

Prior to start of construction, mulch requirements should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process.

- **Material:** As specified in the approved site plan. If not specified, select from mulch materials listed in Table 5.10. The choice should be based upon soils, slope steepness and length, flow conditions and time of year (See Figure 5.4).

Erosion Control Blankets

Practice Description

To aid in controlling erosion on critical areas by providing a protective cover made of straw, jute, wood or other plant fibers; plastic, nylon, paper or cotton. This practice is best utilized on slopes and channels where the erosion hazard is high, and plant growth is likely to be too slow to provide adequate protective cover. Erosion control blankets are typically used as an alternative to mulching but can also be used to provide structural erosion protection. Some important factors in the choice of a blanket are: soil conditions, steepness of slope, length of slope, type and duration of protection required to establish desired vegetation, and probable sheer stress.

K. Grimes, SWCD. St. Charles Co.

Follow manufacturer's recommendations to successfully install erosion control blankets or matting. The manufacturer of this high velocity blanket called for stapling every two feet and a check slot wherever two sections were joined. This blanket was used to protect soil and establish grass in a waterway on the August Busch Memorial Conservation Area.

Recommended Minimum Requirements

Prior to the start of construction, the application of erosion control blankets should be designed by a qualified professional and plans and specifications should be available to field personnel. The field inspector should verify that installation is in accordance with the plans and specifications.

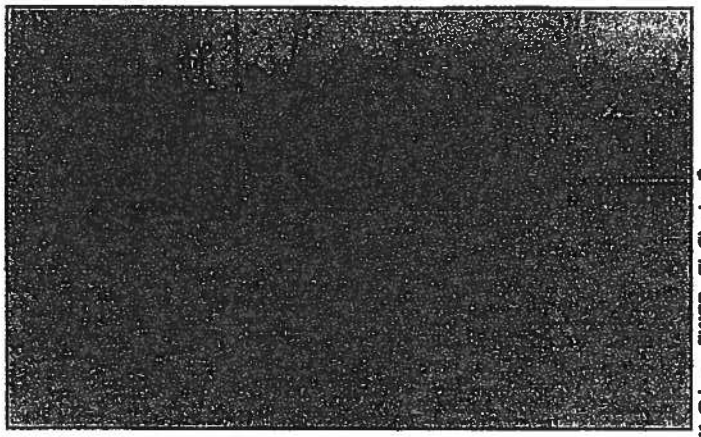
Numerous products designed to control erosion are available. Product installation procedures for manufactured erosion control blanket products should always be available from the manufacturer. Table 5.11 lists some of the more common products available.

Temporary Diversions

Practice Description

A temporary ridge or excavated channel or combination ridge and channel designed to protect work areas from runoff and divert water to sediment traps or stable outlets. Temporary diversions are usually constructed by excavating a channel and using the excavated material to construct a ridge on the down slope side of the channel.

This practice applies wherever stormwater runoff must be temporarily diverted to protect disturbed areas and slopes or to retain sediment on site during construction. These structures generally have a life expectancy of 18 months or less, but can be prolonged with proper maintenance.



K. Grimes, SWCD. SL Charles Co.

An unfinished temporary diversion routes sediment-laden stormwater to a sediment basin. Temporary diversions should be shaped, seeded and mulched. Establish permanent vegetation if the diversion will be used for one year or more.

Recommended Minimum Requirements

Prior to start of construction, temporary diversions should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process.

Temporary diversions should be constructed to minimize erosion at the design flow.

- **Drainage Area:** Less than 5 acres

- **Ridge Design:**
  Side Slope: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  Top Width: 2.0 ft.
  Freeboard: 0.3 ft.
  Settlement: 10% of fill height

- **Channel Design:**
  Side Slope: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  Grade: Stable, positive grade towards outlet, but not exceeding 2%

Construction

Site Preparation

Locate and mark the alignment of the diversion as shown on the plans. The alignment should maintain a stable, positive grade toward the outlet. Minor adjustments to the grade and alignment may be required by site conditions. Realign or elevate the diversion as needed to avoid reverse grade.

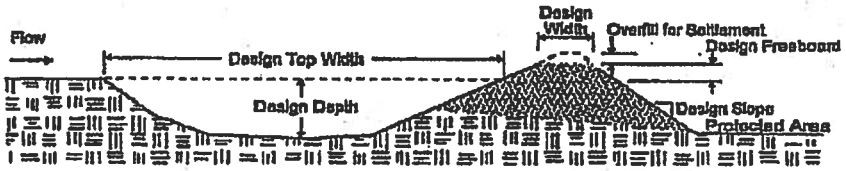


Figure 5.14 Typical Temporary Combination Diversion

Determine exact location of any underground utilities.

Remove trees, brush, stumps and other unsuitable material from site.

Disk the base of the ridge before placing fill.

Grading

Construct the diversion to dimension and grades shown on the design.

Build the ridge 10% higher than designed for settlement, and compact with wheels of the construction equipment or sheepsfoot roller.

Leave sufficient area along the diversion to permit clean out and regrading.

Erosion Control

Stabilize the outlets in accordance with design plans during construction of the diversion.

Place gravel or other surface protection at vehicle crossings to prevent rutting.

Stabilize ridges and channels with vegetation or synthetic erosion control measures as specified in the design.

Outlet should be nonerosive for design flow. Divert flow containing sediment to sediment trap or basin.

Stabilize ridge with vegetation if in place more than 30 working days.

If the diversion is constructed above a steep slope, install temporary slope drains or other stable outlet to control runoff and prevent erosion of the slope (see *Temporary Slope Drains*, *Grass-lined Channel*, *Riprap-lined Channel*).

Construction Verification

The field inspector should verify the dimensions shown on the plans for the following: depth, bottom width, top width, side slopes of channel and ridge, grade of channel bottom, ridge height and channel stabilization techniques.

Check all of the finished grades and configuration of all channels to eliminate constrictions to flow. Also check all ridges for low spots and stability.

Troubleshooting Consult with a registered design professional if any of the following occur:

- Seepage is encountered during construction. It may be necessary to install drains.
- Variations in topography on site indicate diversion will not function as intended.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitutions may be required. Unapproved substitutions could result in erosion and lead to diversion failure.

Maintenance Inspect weekly and following each storm event.

Remove debris and sediment from the channel and rebuild the ridge as needed.

Check outlets and make necessary repairs immediately.

Remove sediment from traps when they are 50% full.

When the work area has been stabilized, remove the ridge and fill in the channel to blend with the natural ground. Remove temporary slope drains and stabilize all disturbed areas with vegetation or other erosion control practices.

Mow grass in channel as shown in the design plan.

Common Problems Sedimentation results in channel grade decreasing or reversing, leading to overtopping—realign or deepen the channel to maintain grade.

Low point in ridge where diversion crosses a natural depression results in overtopping of ridge—build up ridge.

Erosion in channel before vegetation is established results in uneven channel grade, may lead to breach of ridge—repair channel and install sod or synthetic liner.

Seepage or poor drainage in channel results in poor vegetation establishment—install subsurface drains or stone channel bottom.

Vehicle crossing point results in rutting, increased erosion potential—maintain the ridge height, flatten the side slopes, protect the ridge with gravel or hard surface at the crossing point.

Excessive grade in channel results in erosion in channel—repair channel, and install an erosion resistant lining or realign to reduce the grade.

Excessive velocity at outlet results in erosion—install an outlet stabilization structure (see *Rock Outlets* or *Energy Dissipators*).

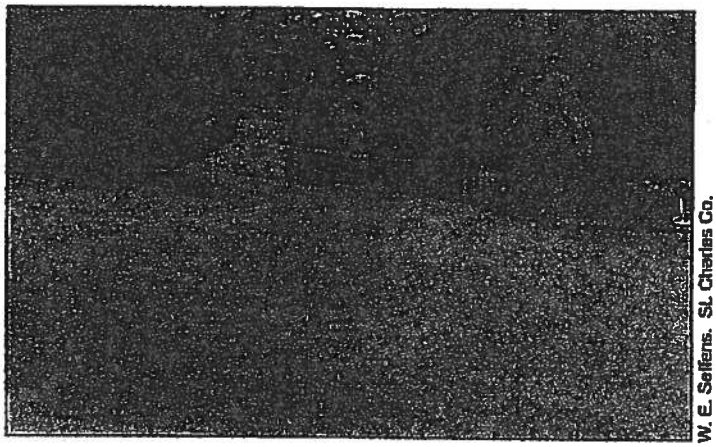
Ridge not compacted, runoff from a storm event may cause failure—repair and use construction equipment to compact.

Permanent Diversion

Practice Description

A watercourse constructed across a slope which may consist of an excavated channel, a compacted ridge or a combination of both. Most permanent diversions are constructed by excavating a channel and using the excavated material to construct a ridge on the downslope side of the channel.

This practice applies to wherever stormwater runoff can be redirected to protect downslope structures or areas from erosion, sediment, and excessive wetness or localized flooding. They are designed to intercept and carry excess water to a stable outlet where it can be temporarily stored or released.



W. E. Seffens, St. Charles Co.

Permanent diversions provide long-term protection for the areas below as they route runoff to a stable outlet. They also allow time for vegetation to become established on the protected slopes. Generally, fences, trees and other obstructions should not be located in the channel.

Recommended Minimum Requirements

Prior to start of construction, permanent diversions should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process. The diversion should be built according to planned alignment, grade and cross section.

- Drainage Area: Less than 5 acres

- **Ridge Design:**
  Side Slopes: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  Top Width: 2.0 ft. minimum
  Height: 1.5 ft.
  Freeboard: 0.5 ft.
  Settlement: 10% of fill height

- **Channel Design:**
  Shape: Parabolic, Trapezoidal or V-shaped
  Side Slopes: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  Grade: Stable, positive grade towards outlet

- **Erosion Control:** Establish vegetation on ridges and channels as soon as possible or use synthetic erosion control measures as specified in the design.

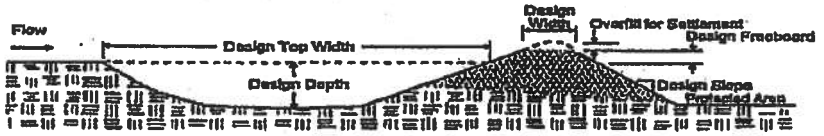


Figure 5.15 Typical Trapezoidal Permanent Diversion

Construction

Site Preparation

Determine exact location of any underground utilities.

Locate and mark the alignment of the diversion as shown on the plans. The alignment should maintain a positive grade towards the outlet. Minor adjustments to the grade and alignment may be required to meet site conditions.

Clear the construction area of trees, stumps, brush, sod and all other unsuitable material which would interfere with compaction of the ridge.

Disk or scarify the area where the ridge is to be installed before placing the fill.

Clean out, fill and compact all ditches, swales or gullies to be crossed.

Apply gravel or hard surface protection at vehicle crossings to prevent rutting.

Install vegetated outlets prior to construction. Adequate vegetation should be established in the outlet channel. If vegetation cannot be established, consider using erosion control blankets or constructing a stabilized outlet (See *Rock Outlets* and *Energy Dissipators*).

Grading

Excavate, fill, shape and stabilize the diversion to planned alignment, grade and cross section. The channel should have a positive grade toward the outlet to avoid ponding. Where possible, blend diversion into the surrounding landscape.

Overfill and compact the ridge, allowing for 10% settlement. The settled ridge top must be at or above design elevation at all points. Compaction may be achieved by driving wheeled equipment along the ridge as lifts are added. Fill should be placed in lifts of no more than 6 to 8 inches in depth.

Erosion Control

Leave sufficient area along the diversion to permit clean out and regrading.

Install gravel or hard surface protection at vehicle crossings.

Stabilize diversion outlets in accordance with plans.

Control sediment with silt fence (or other appropriate measures) along grading limits. Diversions carrying sediment from disturbed areas must empty into sediment traps or basins.

Immediately after installation use permanent vegetation or other means to stabilize the diversion in accordance with plans.

Construction Verification

Check finished grades and cross section of all channels to eliminate constrictions to flow. Also check all ridges for low spots and stability.

Troubleshooting

Consult with registered design professional if any of the following occur:

- Seepage is encountered during construction. It may be necessary to install drains.
- Variations in topography on site indicate diversion will not function as intended.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitutions may be required. Substitutions not approved by the design professional could result in erosion and lead to diversion failure.

Maintenance

Inspect weekly and following each storm event for eroded areas until the diversion is vegetated, then periodically and after major storms.

Remove debris and sediment from the channel, and rebuild the ridge to design elevation where needed.

Check diversion outlets and keep in good repair to prevent erosion.

Maintain vegetation with periodic fertilization and mowing to keep plantings in a vigorous, healthy condition. Mowing for weed and brush control during the first year should generally be done at a height of 4 inches to prevent seedling damage.

When the a work area has been stabilized, remove sediment traps and repair bare or damaged areas in the vegetation.

Stabilize all eroded, rutted or disturbed areas as soon as possible with vegetation or synthetic erosion control measures as specified in the design.

Common Problems

Rutting at vehicle crossings; increases erosion potential—maintain ridge height, protect with gravel or hard surface or flatten side slopes.

Silt may accumulate in diversions resulting in channel grade decreases or reverses, leading to overtopping—remove silt in the channel to maintain grade.

Ridge overtops—diversions crossing natural depressions should be constructed to avoid dips in the ridge.

Erosion in channel before vegetation is established; results in uneven channel grade, may lead to breach of ridge—install sod or synthetic liner.

Seepage or poor drainage in channel; results in poor vegetation establishment—install subsurface drains.

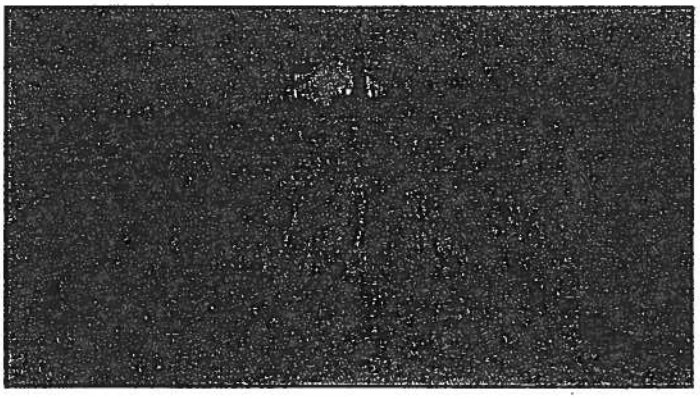
Outlets not stabilized; results in scour at the diversion outlet—repair erosion, reevaluate erosive velocities and recommended erosion protection measures.

Permanent Diversion _____

Perimeter Protection

Practice Description

A berm or channel constructed along the outside edge of a disturbed construction area to prevent damage from stormwater runoff or sediment. These diversions are used on the upslope side of a construction site to prevent surface runoff from entering the disturbed area. They can also be used on the downslope side to divert sediment-laden runoff to on-site sediment traps or basins. Diversions for perimeter protection can be either temporary or permanent.



N. Klopfenstein, NRCS, St. Charles Co.

Even when everything is done right (permanent seeding with a tackified mulch), a heavy rain can cause rills and gullies in cut-and-fill slopes. A diversion at the top of the slope could have prevented the need to regrade and reseed.

Recommended Minimum Requirements

Prior to start of construction, diversions should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process. The diversion should be built according to planned alignment, grade and cross section.

- **Drainage Area:** Less than 5 acres
- **Berm Design:**
  Side Slopes: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  Top Width: 2.0 ft.
  Height: 1.5 ft.
  Freeboard: 0.5 ft.
  Settlement: 10% of fill height

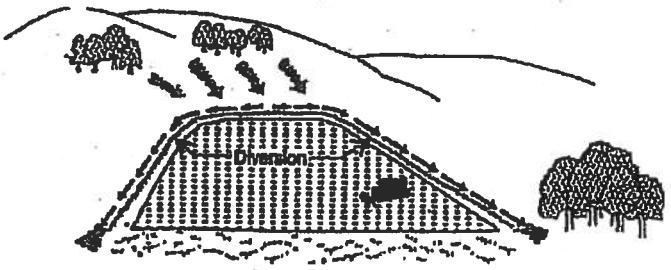


Figure 5.16 Typical Perimeter Protection

- **Channel Design:**
  - Shape: Trapezoidal, Parabolic or V-shaped
  - Side Slopes: 2:1 or flatter; 3:1 or flatter where vehicles must cross
  - Stabilization: As specified in the design plan; based on velocity by reaches
  - Grade: Stable, positive grade towards outlet, but not exceeding 2%

- **Outlet:** Stable, with sediment-laden water diverted to a sediment trap or basin; and runoff from undisturbed areas diverted to a stable natural outlet or outlet stabilization structure

Construction

Site Preparation

Determine exact location of any underground utilities.

Remove all trees, brush, stumps or other debris from the site, and dispose of properly.

Fill and compact all ditches or gullies to be crossed.

Scarify the base of the berm before placing the fill.

Grading

Fill the berm higher than the design elevation , and compact with wheels of the construction equipment to design height plus 10%.

Construct the channel to the dimensions and elevations shown on the plan.

Leave enough area along the diversion to permit access by machines for clean out and maintenance.

Install outlet protection and sediment traps according to the design plan.

Erosion Control

Stabilize the channel using temporary lining to protect vegetation as specified in the design plan.

Establish vegetation on the berm immediately following construction. If diversion is temporary, restore berm and channel to original grade after disturbed area is stabilized and establish vegetation as soon as possible.

Stabilize the disturbed areas.

Construction Verification

Check finished grade and cross section of berm or channel around the perimeter.

Check channel cross sections at several locations to eliminate constrictions to flow.

Troubleshooting

Consult with registered design professional if any of the following occur:

- Variations in topography on site indicate perimeter protection will not function as intended. Changes in plan may be needed.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitution may be required. Unapproved substitutions could result in failure of the perimeter protection.

Maintenance

Inspect the berm periodically and after every storm event.

Remove debris and sediment from the channel immediately.

Repair the berm to its original height if damaged.

Check outlets and make necessary repairs to prevent gully formation.

Clean out sediment traps when 50% full.

Once the work area has been stabilized, remove the sediment traps, disposing of unstable sediment in a designated disposal area.

Common Problems

Erosion in channel from excessive grade—install an erosion-resistant lining in the channel.

Overtopping caused by sediment in channel where grade decreases or reverses—deepen the channel or realign the grade.

Overtopping at low point in ridge where diversion crosses shallow draw—rebuild the ridge with a positive grade towards the outlet at all points.

Erosion at outlet—install an outlet stabilization structure.

Sedimentation at diversion outlet—install a temporary sediment trap.

Temporary Swale

Practice Description

A linear depression in the ground surface which carries drainage run-off, but does not block traffic, as do ditches, gutters or diversions. This practice applies anywhere a drainage conveyance is required and can be used as an alternative to closed pipe systems. Grassed swales also provide the benefits of reducing stormwater velocity, promoting infiltration and removing sediment.

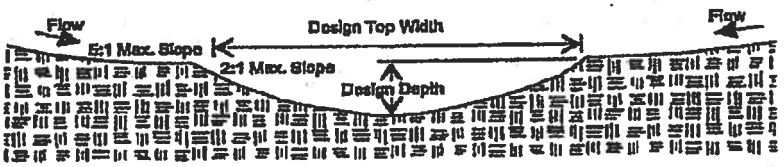


Figure 5.17 Cross Section of Typical Temporary Swale

Recommended Minimum Requirements

Prior to start of construction, temporary swales should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. The swale should be built according to planned alignment, grade and cross section.

- Drainage Area: Less than 3 acres
- Ground Slopes: Ground slopes leading to the swale should have a grade of 5:1 or less

Construct temporary swales to minimize erosion at the design flow.

Construction

Site Preparation

Determine exact location of any underground utilities.

Locate and mark the alignment of the swale as shown on the plans. The alignment should maintain a positive grade towards the outlet to avoid

ponding. Minor adjustments to the grade and alignment may be required by site conditions.

Remove trees, brush, stumps and other debris from the site.

Grading

Excavate, fill and shape the swale to planned alignment, grade and cross section.

Erosion Control

Stabilize the outlets during the construction of the swale.

Seed, mulch or sod the swale immediately after construction.

Construction Verification

Check finished grade and cross section of swale throughout its length to ensure that it is free of constrictions and reverse grades.

Troubleshooting

Consult with a registered design professional if any of the following occur:

- Variations in topography on site indicate swale will not function as intended. Changes in the plan may be needed.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitutions may be required. Unapproved substitutions could result in erosion and lead to failure.
- Poorly drained soils that contain high amounts of clay are found on the site. These types of soils may cause prolonged surface ponding of water.

Maintenance

Inspect following each storm event.

Remove sediment from the swale as needed.

Repair erosion damage immediately.

Check outlets and make necessary repairs immediately.

Common Problems

Vehicle crossing point; can cause rutting and increase erosion—flatten the side slopes and protect the swale with gravel at the crossing point.

Excessive grade in channel; results in channel erosion—realign to reduce the grade.

Excessive velocity at outlet; results in erosion—install an outlet stabilization structure.

Seepage or poor drainage in swale; results in poor vegetation establishment—install subsurface drains or stone channel bottom.

Temporary Swale

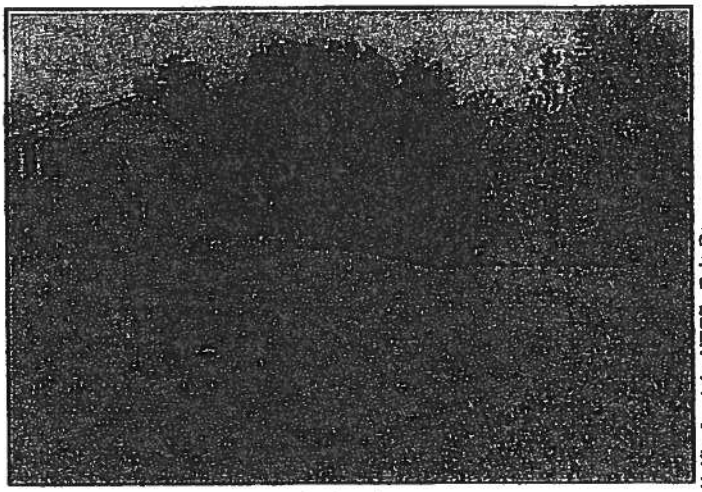
Grass-lined Channel

Practice Description

A grass waterway constructed for the purpose of handling concentrated surface runoff in such a way as to prevent damage from erosion and siltation. This practice applies to sites where:

- concentrated runoff will cause erosion damage,
- a vegetative lining provides sufficient stability for the channel as designed,
- channel grades are generally less than 5% and
- space is available for a relatively large cross section.

Typical uses include roadside ditches, channels at property boundaries, outlets for diversions and stabilizing concentrated flow areas.



N. Klopfenstein, NRCS, Cole Co.

Establish permanent vegetation as quickly as possible so that grassed waterways can be used. Erosion control matting will provide immediate protection if the waterway is needed before grass is established.

Recommended Minimum Requirements

Prior to start of construction, grass-lined channels should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process. The channel should be built according to planned alignment, grade and cross section.

- **Cross Section:** Trapezoidal or parabolic
- **Side Slopes:** 3:1 or flatter for trapezoidal channels
- **Channel Stabilization:** Use mulch, erosion control blankets, turf reinforcement mats or other appropriate practices as specified in the design plan.
- **Outlet:** Channels should empty into sediment traps, detention/retention basins or stable outlets.
- **Subsurface Drain:** Use in areas with seasonally high water tables or seepage problems.

Construction

Site Preparation

Determine exact location of underground utilities.

Install sediment traps or drains if needed.

Remove brush, trees and other debris from the construction area and dispose of properly.

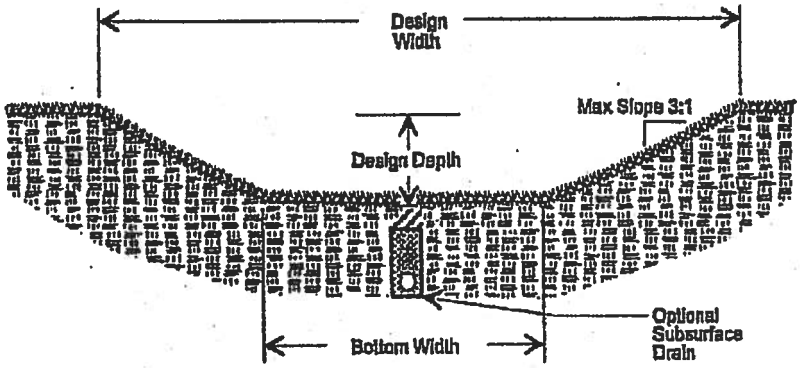


Figure 5.19 Typical Trapezoidal Grass-lined Channel

Grading

Excavate and shape the channel to dimensions shown on the design specification, removing and properly disposing of excess soil so surface water can enter the channel freely.

If subsurface drain is needed, install it offset to one side of the channel.

Provide topsoil as needed to grow grass on areas disturbed by construction.

Erosion Control

Protect all concentrated inflow points along the channel with erosion-resistant linings, riprap, sod or other appropriate measures.

Fertilize and seed or sod the channel immediately after grading; and protect with erosion control blankets, turf reinforcement mats or mulch according to the design plan.

Channel should outlet at a stable location.

Construction Verification

Check finished grade and cross section of channel throughout the length of the watercourse. Verify channel cross sections at several locations to avoid constrictions to flow.

Troubleshooting

Consult with registered design professional if any of the following occur:

- Variations in topography on site indicate channel will not function as intended. Changes in plan may be needed.
- Side slope cave ins resulting from unstable, high-water-table soil, steep banks or high-flow velocity. Most likely to occur on the outside of channel curves.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitution may be required. Unapproved substitutions could result in channel erosion.

Maintenance

Inspect the channel following storm events both during and after grass cover is established; make needed repairs immediately.

Check the channel outlet and road crossings for blockage, sediment, bank instability, breaks and eroded areas remove any blockage and make repairs immediately.

Remove significant sediment and debris from the channel to maintain design cross section and grade and to prevent spot erosion.

Common Problems

Erosion occurs in channel before vegetation is fully established—repair, reseed and install erosion control blankets or turf reinforcement mats.

Gullying, head cutting or settling in channel; grade is too steep for a grass lining or drain was installed in the center of the channel, not off to the side—redesign the channel and utilize erosion-resistant lining.

Overbank erosion, spot erosion, channel meander or flooding—remove accumulated debris and sediment, and stabilize and revegetate trouble spots.

Ponding along channel; the approach is not properly graded or surface inlets are blocked—improve channel grade or remove blockage.

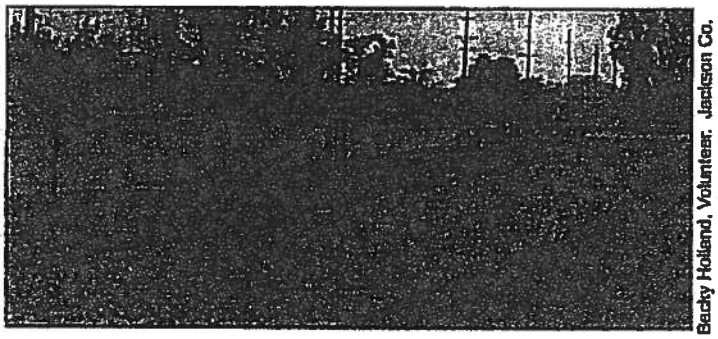
Erosion at channel outlet—install an outlet stabilization structure.

Sediment deposited at channel outlet; indicates channel or watershed erosion—find and repair the source of any channel erosion, stabilize the watershed, or install temporary diversion and sediment traps to protect the channel from sediment-laden runoff.

Riprap-lined Channel

Practice Description

Waterways with an erosion-resistant rock lining designed to carry concentrated runoff to a stable outlet. This practice applies where conditions are expected to be unsuitable for use of grass-lined channels, such as: 1) channels with average grades over 5%, continuous or prolonged flows occur, potential for damage from traffic exists, or soils are erodible and soil properties are not suitable for vegetation; 2) design velocities exceed 5 feet per second; 3) channel location warrants the use of increased protection; or 4) channel will have prolonged periods of wetness which will hinder growth of grass.



Becky Holland, Volunteer. Jackson Co.

Rock-lined channels, like this one in Independence, can be used in areas with high flow velocities or where vegetation is hard to establish.

Recommended Minimum Requirements

Prior to start of construction, riprap-lined channels should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process. The channel should be built according to planned alignment, grade and cross section.

- **Cross Section:** As shown in the design specifications
- **Side Slopes:** 2:1 or flatter
- **Riprap/Rock:** Size and gradation as shown in design specifications. Riprap should consist of a well-graded mixture of stone. Larger stone should predominate, with sufficient smaller sizes to

fill the voids between the stones. The diameter of the largest stone size should be not greater than 1.5 times the d_{50} size.

- **Riprap Thickness:** Minimum thickness of riprap should be 1.5 times the maximum stone diameter.
- **Stone or Rock Quality:** Select stone for riprap from field stone or quarry stone. The stone should be hard, angular, and highly chemical- and weather- resistant. The specific gravity of the individual stones should be at least 2.5.
- **Foundation:** Geotextile filter fabric or rock aggregate filter layer under the riprap
- Outlet: Stable, non-erosive

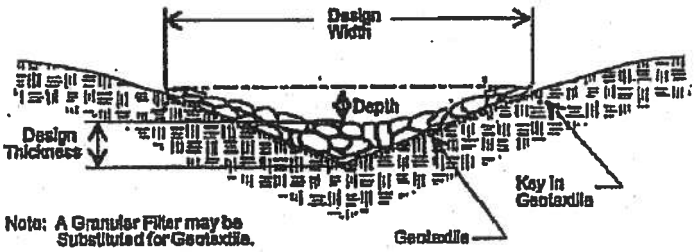


Figure 5.20 Typical V-shaped Riprap-lined Channel

Construction

Site Preparation

Determine exact location of underground utilities.

Remove brush, trees and other debris from the channel and spoil areas, and dispose of properly.

Excavate cross section to the lines and grades shown in design specifications. Overexcavate to allow for thickness of riprap and filter material.

Installation

Install geotextile fabric or aggregate in the excavated channel as a foundation for the riprap. Anchor fabric in accordance with design specifications.

As soon as the foundation is prepared, place the riprap to the thickness, depth and elevation shown in the design specifications. It should be a dense, uniform and well-graded mass with few voids.

Blend the finished rock surface with the surrounding land surface so there are no overfalls, channel constrictions or obstructions to flow.

Erosion Control

Stabilize channel inlet points and install needed outlet protection prior to or during channel construction.

Stabilize disturbed areas after construction is completed.

Construction Verification

Check finished grade and cross section of channel throughout the length of the watercourse. Verify channel cross sections at several locations to avoid flow constrictions.

Troubleshooting

Consult with registered design professional if any of the following occur:

- Variations in topography on site indicate channel will not function as intended; changes in plan may be needed.
- Design specifications for riprap sizing, filter fabric or aggregate filter cannot be met; substitution may be required. Unapproved substitutions could result in channel erosion.

Maintenance

Inspect channels at regular intervals and after storm events.

When stones have been displaced, remove any debris and replace the stones in such a way as to not restrict the flow of water.

Give special attention to outlets and points where concentrated flow enters the channel, and repair eroded areas promptly.

Check for sediment accumulation, piping, bank instability and scour holes; repair promptly.

Common Problems

Foundation excavation not deep enough or wide enough; may cause riprap to restrict channel flow and result in overflow and erosion—deepen channel and replace riprap.

Side slopes too steep; causes instability, rock material movement and bank failure—flatten side slopes.

Filter omitted or damaged during stone placement; may result in piping and bank instability—install filter and replace stone.

Riprap poorly graded or stones not placed to form a dense, stable channel lining; may result in rock displacement and erosion of the foundation—replace riprap with properly sized, well graded material.

Riprap installed smaller than specified; may result in rock displacement—selectively grouting over rock materials may stabilize the situation.

Riprap not extended far enough downstream; may result in undercutting—the channel should outlet on a stable location; extend riprap as needed.

Riprap not blended to ground surface; may result in gullying along edge of riprap—regrade riprap to blend with ground surface.

Riprap not installed until after washout of other materials has occurred—replace eroded material and install riprap.

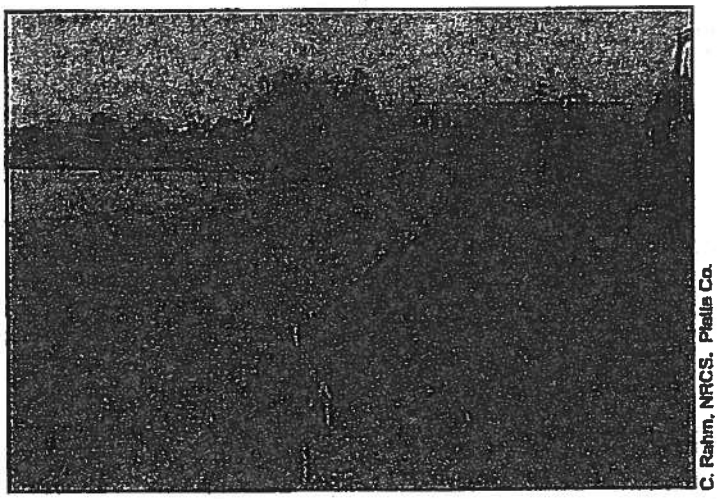
Riprap just dumped and not properly shaped; may result in rock displacement and erosion—repair eroded area and reshape riprap to attain proper channel shape.

Sediment Fence

Practice Description

A temporary sediment barrier consisting of a geotextile fabric which is attached to supporting posts and trenched into the ground. Sediment-laden runoff ponds uphill from the sediment fence and runoff is temporarily stored to allow sediment to settle out of the water.

This practice applies where sheet erosion occurs on small disturbed areas. Sediment fences are intended to intercept and detain small amounts of sediment from disturbed areas in order to prevent sediment from leaving the site. Sediment fences can also prevent sheet erosion by decreasing the velocity of the runoff.



C. Rahm, NRCS, Platte Co.

A properly installed sediment fence slows water flow long enough for the sediment to settle out.

Recommended Minimum Requirements

Prior to start of construction, sediment fences should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process.

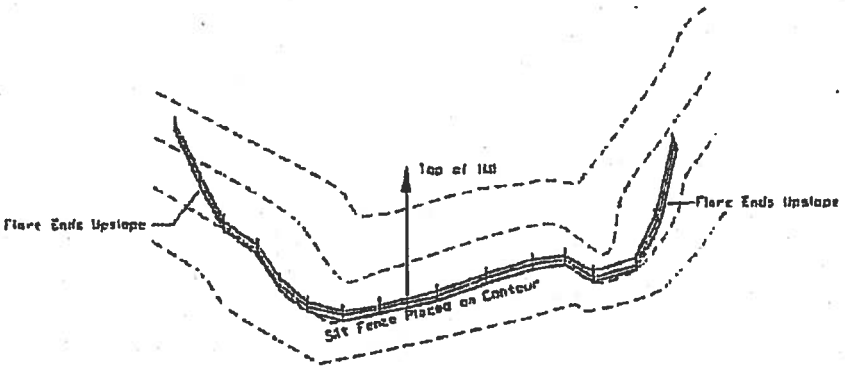
- Drainage Area: Limited to 1/4 acre per 100 feet of fence. Area is further restricted by slope steepness as shown in Table 5.16.

- **Location:** Fence should be built on a nearly level grade and at least 10 feet from the toe of the slope to provide a broad shallow sediment pool. Install on the contour, where fence can intercept runoff as a sheet flow; not located crossing channels, waterways or other concentrated flow paths; not attached to existing trees.

- **Length:** Maximum of 600 feet; flare ends of fence uphill to temporarily impound water as shown in Figure 5.33a.

Table 5.16 Typical Land Slope and Distance for Sediment Fence

Land Slope (%)	Maximum Slope Distance * above Fence (feet)
less than 2	100
2 to 5	75
5 to 10	50
greater than 10	*



* Follow manufacturers' recommendations for proper spacing.

Figure 5.33a Placement of Sediment Fence

- **Spacing of Support Posts:** 10 feet maximum for fence supported by wire; 6 feet maximum for high strength fabric without supportive wire backing

- **Trench:** Bottom 1 foot of fence must be buried minimum of 6 inches deep.

- **Impounded Water Height:** Depth of impounded water should not exceed 1.5 feet at any point along the fence.

- **Support Posts:** 4-inch diameter wood or 1.33 lb/linear foot steel, buried or driven to a depth of 24 inches with support wire; 2-inch square wood or 1.0 lb/linear foot steel without support wire. Steel posts should have projections for fastening fabric.

Table 5.17 Example Specifications for Sediment Fence Fabric

Physical Property	Minimum Requirement
Filtering Efficiency	85%
Tensile strength at 20% (maximum) elongation:	
Standard strength	30 lb/linear inch
High strength	50 lb/linear inch

Source: Adapted from North Carolina Field Manual, 1991

- **Support Wire:** Wire fence (14-gauge with 6-inch mesh), necessary if standard strength fabric is used

- **Reinforced, Stabilized Outlets:** Should be located to limit water depth to 1.5 feet measured at lowest point along crest line.
  - Crest Height: 1 foot maximum
  - Width of splash pad: 5 feet maximum
  - Length of splash pad: 5 feet minimum
  - Supports: 4 foot spacing

- **Synthetic Geotextile Fabric:** Conforming to specifications in Table 5.17 and containing ultraviolet light inhibitors and stabilizers. Minimum design life of 6 months.

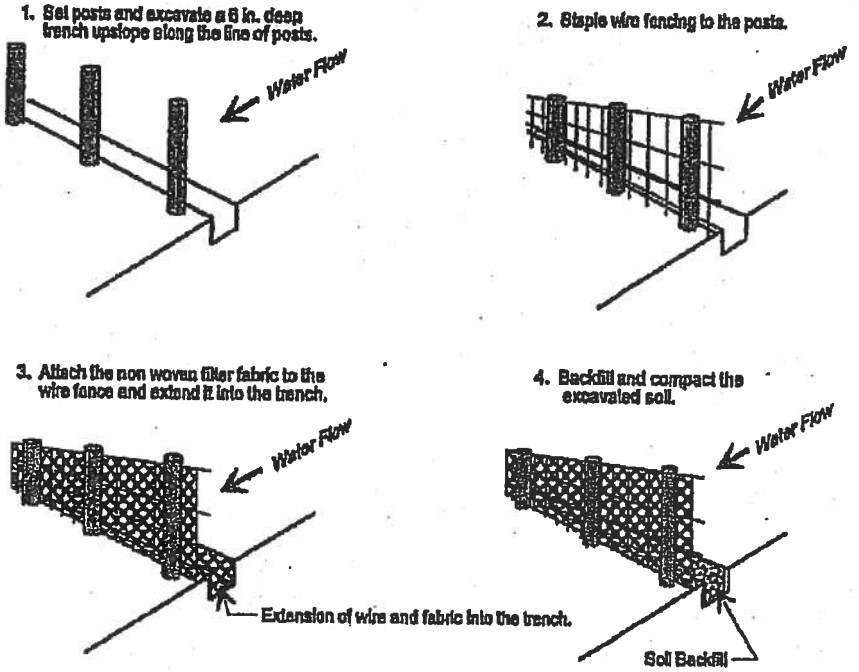


Figure 5.33 Installation of Sediment Fence

Construction

Site Preparation

Determine exact location of underground utilities.

Grade alignment of fence as needed to provide broad, nearly level area upstream of fence.

Fence Installation

Dig a trench at least 6 inches deep along the fence alignment as shown in Figure 5.33.

Drive posts at least 24 inches into the ground on the downslope side of the trench. Space posts a maximum of 10 feet if fence is supported by wire, or 6 feet if high strength fabric and no support fence is used.

Fasten support wire fence to upslope side of posts, extending 6 inches into the trench as shown in Figure 5.33.

Attach continuous length of fabric to upslope side of fence posts. Try to minimize the number of joints. Avoid joints at low points in the fence line. Where joints are necessary, fasten fabric securely to support posts and overlap to the next post.

Place the bottom 1 foot of fabric in the 6-inch deep trench (minimum), lapping toward the upslope side. Backfill with compacted earth or gravel as shown in Figure 5.34.

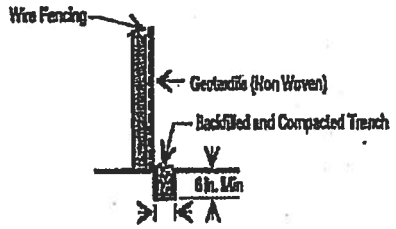


Figure 5.34 Detail of Sediment Fence Installation

To reduce maintenance, excavate a shallow sediment storage area in the upslope side of the fence. Provide good access in areas of heavy sedimentation for clean out and maintenance.

Reinforced Stabilized Outlet Installation

Allow for safe bypass of storm flow to prevent overtopping failure of fence.

Set outlet elevation so that water depth cannot exceed 1.5 feet at the lowest point along the fence.

Drive posts securely at least 24 inches into the ground, at a spacing of 4 feet. Install a horizontal brace between the support posts to serve as an overflow weir and to support the top of the fabric.

Immediately downslope of the fabric, excavate foundation for splashpad a minimum of 5 feet wide, 5 feet long and 1 foot deep. Place 1 foot of riprap in the excavated foundation. The surface of the riprap should be flush with the undisturbed ground (no outfall).

Erosion Control

Stabilize disturbed areas in accordance with vegetation plan.

Construction Verification

Check finished grades and dimensions of the sediment fence. Check materials for compliance with specifications.

Troubleshooting

Consult with registered design professional if any of the following occur:

- Variations in topography on site indicate sediment fence will not function as intended; changes in plan may be needed.
- Design specifications for filter fabric, support posts, support fence, gravel or riprap cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Maintenance

Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

Should the fabric of a sediment fence collapse, tear, decompose or become ineffective, replace it promptly.

Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid damaging or undermining the fence during cleanout.

Straw Bale Sediment Trap

Practice Description

A temporary catch basis consisting of a row or more of entrenched and anchored straw bales.

This practice applies downstream of small disturbed areas that are subject to sheet erosion or in minor swales with less than 2 acres of drainage area. The purpose is to intercept and detain small amounts of sediment in order to prevent sediment from leaving the construction site.

K. Grimes, SWCD, St. Charles Co.

Straw bale sediment traps are not suitable for drainage areas larger than two acres. A rock dam or a sediment basin would have been a better choice for erosion and sediment control on this site.

Recommended Minimum Requirements

Prior to start of construction, straw bale sediment traps should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. The straw bale sediment trap should be built according to planned grades and dimensions.

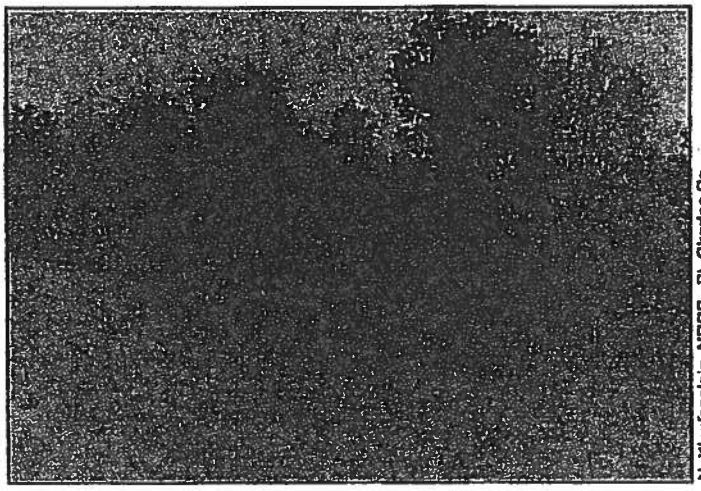
- Drainage Area:
  Areas subject to sheet erosion: 1/4 acre per 100 feet of barrier
  Minor swales: less than 2 acres
  Area is further restricted by slope steepness as shown in Table 5.18

Filter Strip

Practice Description

A wide belt of vegetation designed to provide infiltration, intercept sediment and other pollutants, and reduce stormwater flow and velocity. Filter strips are similar to grassed swales except that they are designed to accept only overland sheet flow. They cannot treat high velocity flows. Surface runoff must be evenly distributed across the filter strip. Once a channel forms in the filter strip, it is no longer effective.

Filter strips can consist of grass, woody vegetation or other erosion resistant plants. They can be used in conjunction with infiltration basins, infiltration trenches or alongside streams to filter sediment from runoff.



N. Klopfenstein, NRCS. St. Charles Co.

Filter strips slow surface runoff, reduce sedimentation and help filter pollutants. Depending on the choice of plant materials, they can be low maintenance areas (mow once or twice a year) or provide habitat for wildlife.

Recommended Minimum Requirements

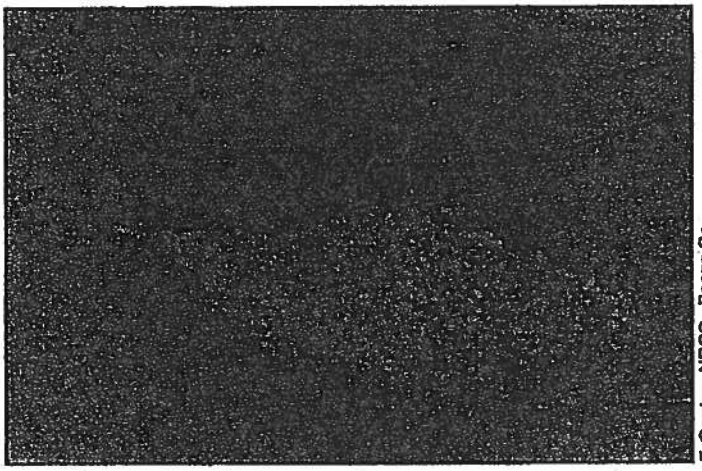
Prior to start of construction, filter strips should be designed by a qualified professional. Plans and specifications should be referred to by field personnel throughout the construction process. The filter strip should be built according to planned alignment, grade and cross section.

Sediment Basin

Practice Description

A barrier or dam with a controlled stormwater release structure formed by constructing an embankment of compacted earth fill across a drainageway.

This practice applies where erosion control measures are insufficient to prevent off-site sedimentation. The purpose of a sediment basin is to detain sediment-laden runoff from disturbed areas in "wet" or "dry" storage long enough for most of the sediment to settle out.



F. Gordon, NRCS, Boone Co.

A sediment basin is suitable for small drainageways and can be used to pretreat sediment-laden water before it enters a permanent pool. A rock chute was used to drop the water to a lower elevation.

Recommended Minimum Requirements

Prior to the start of construction, sediment basins should be designed by a registered design professional. Plans and specifications should be referred to by field personnel throughout the construction process. The sediment basin should be built according to planned grades and dimensions.

- . Dam height: 10 feet or less
- Contributing drainage area: 20 acres or less